



International Journal of Allied Practice, Research and Review

Website: www.ijaprr.com (ISSN 2350-1294)

Physicochemical analysis of Bhima river water in jurisdiction of Khed Tahsil, Pune (MS) India

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ABSTRACT- Physicochemical parameters such as Atmospheric Temperature(AT), Water Temperature(WT), Potentia Hydrogenii (pH), Electrical Conductivity(EC), Total Dissolved Solid(TDS), Alkalinity(ALK), Dissolved Oxygen(DO), chloride, Total Hardness(TD), Dissolved oxygen and Chloride of surface water was carried out on monthly basis for nine months. The study was carried out at several places on Bhima River which flows through Rajgurunagar. Eight places were monitored from July to February on monthly basis. It was observed that the physicochemical and biological parameter of this river fluctuate from place to place due to discharge of agricultural, municipal as well as industrial water into it. The water is not at all portable for human consumption and for livestock.

Keywords: Impact; effluent and water quality of river

I. INTRODUCTION

Rajgurunagar is a historical town in Pune district situated along national highway 50. River Bhima originates from Sahyadri hilly range area. The study areas have been selected where sugar industries, number of factories effluents are discharged into river. Under present study - The quality of life linked with the quality of environment, hence biological components, of fresh water depend slowly on better physicochemical conditions, and therefore analysis of physicochemical parameters of water is essential. Water is very essential and important for human life. Water is the soul of nature. It is one of the prime and basic needs of mankind. It is most important environmental factor and is essential for well being of the living world, is especially for human population. Through the quality criteria of water are different sometimes water is not suitable for drinking and other purposes because of contaminations. (Kulkarni, 1990) wrong agricultural practices also deteriorate the quality of water by percolation of contaminants through sub soil, and bedrock, and rich the ground water table (Phonde, et al. 1992).

Extensive work on surface water pollution (Khan and Hussain, 1976; Ghosh and George, 1989; Pande et al. 1993; Shrivastava and Patil 2013) and ground water pollution (Ugam Kumari and Dilip Pathak, 1993; Phonde et al. 1997; Dhembare and Phonde, 1997; Mishra and Patel, 2001) have been done in India).

There are trends in developing countries to use sewage effluent as fertilizers has gained much importance as it is considered a source of organic matter and plant nutrients and serves as a good fertilizer (Riorden; (1983). Plants can accumulate heavy metals in their tissues in concentrations above the permitted levels

which is considered to represent a threat to the life of humans, and animals feeding on this crops and may lead to contamination of food chain, as observed that soil and plants contained many toxic metals, that received irrigation water mixed with industrial effluent (Adnan Amin 2010).

Opinya et.al.,(1987) reported that low or high level of fluoride ions concentration in water as the major cause of dental fluorosis. Low concentration of iodine in Homo sapiens results in goiter. In infants have been considered as a potential high risk group to the toxic effects of sodium from drinking water (Smith, 1974). Ten physicochemical parameters such as atmospheric Temperature (AT), Water Temperature(WT), Potentia Hydrogenii (pH),Electrical Conductivity(EC), Total Dissolved Solid(TDS), Alkalinity (ALK), Dissolved Oxygen (DO), Calcium Hardness , Total Hardness (TD) , Dissolved oxygen and Chloride of surface water of these eight spots were monitored on monthly basis.

II. MATERIAL AND METHOD

From the general survey regarding physicochemical studies of Bhima river, the samples were collected from selected spots/fixed spots on the basis of topography of eight spots or locations were recognized for sampling. The water samples were collected from these spots from July 2013 to March 2014. These samples were collected in clean dry polythene containers of two liter capacity. The collection spots are as follows: 1) Kolpewadi 2) Chaskama 3) Saygav 4) Donde 5) ETP 6) H.R.M.College 7) Brick Factory 8) Chas

1. Environmental Temperature: The reading should be made by dipping the thermometer in the sample. Sufficient time should be allowed before constant reading is obtained. The temperature should be expressed to the nearest degree centigrade.

2. Water Temperature: Thermometer is immersed directly in the water body for a period of time sufficient to permit constant reading, while collecting the sample, care was taken that it is not exposed to heat or direct solar radiation.

3. pH: Immersed the probe directly in the water collected in a wild mouthed sampling bottle at the sampling side immediately after collection of a period of time sufficient to permit most constant reading. The pH of sewage water sample was determined by potentiometric method as described by APHA (1985).

4. Electrical conductivity:

Electrical conductivity is a measure of a water's capacity to convey electric current. The ability of a solution to conduct an electric current is governed by the migration of solutions and is dependent on the nature and number of the ionic species in that solution. This property is called electrical conductivity.

5 Total Dissolved Solid: (TDS) Centrifuge or filter a suitable volume of No.30 or equivalent filter paper. Evaporate the filtered sample in a dish. Dry the residue at 103°C - 108°C. The increase in weight of dish equals the total dissolved solids. It may also be obtained by the difference between total solids and total suspended solids.

6) Alkalinity: The alkalinity of water is a measure of its capacity to neutralize acids. It is an anionic phenomenon.

7) Total Hardness (TH): Hardness is the capacity destroying of water for reducing and the lather soap. Hardness in water is due to the natural accumulation of salts from contact with soil and geological

formation or it may enter from direct pollution by industrial effluents. Calcium and magnesium are the principle cations causing hardness.

8) **Chloride:** Chloride is the common anion found in water and sewage. The concentration of chloride in natural water varies from few milligrams to several thousand milligrams per liter. Higher concentration of chlorides may be due to contamination by sea water, sewages or industrial effluents.

9) **Turbidity:** Turbidity is an important parameter for characterizing water quality. It is an expression of optical property of a sample containing in-organic substances which cause light to be scattered rather than transmitted to straight lines. Turbidity was due to the presence of fine particles in the sample. This property was measured by means of digital nephelometer .

10. **Dissolved oxygen:** Oxygen is dissolved in most waters in varying concentrations. Solubility oxygen depends on temperature, pressure and salinity of water.

III. RESULT

The water quality analysis of Bhima river water has been carried out from the month July 2013 to March 2014 for the predefined eight sampling stations. It is observed that the physicochemical and biological parameter feature of this river fluctuate from place to place due to discharge of agricultural , municipal as well as industrial water into it.

1. **Atmospheric Temperature:** The atmospheric temperature was found to be in the range between 24 °C – 38 °C. It was maximum during March and minimum during November. It was higher during summer season and lower during winter season. Similar observation was recorded by Bade et.al. (3) in Sai reservoir, Latur and Manjare et.al.(11) in Tandale tank, Kolhapur.

Atmospheric Temperature °C									
Spots	Months								
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	32	31	29	29	28	29	30	32	32
2	31	29	28	28	28	28	29	31	32
3	31	31	29	27.5	26	28	31	32	33
4	32	30	27	27	27	27	30	31	33
5	29	28	26	26	26	28	31	35	38
6	30	30	28	27	27	30	32	36	37
7	32	31	28	27	28	29	32	36	38
8	30	28	26	25	24	26	29	30	31

2) **Water Temperature:** Water temperature of Bhima River ranged between 20-31 °C. The minimum water temperature recorded in the winter season and maximum in the summer season. Similar results were reported by Jayabhaye et.al. (6) And Salve et.al.(14).

Water Temperature °c									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	28	24	24	21	20	20	20	22	23
2	26	23	23	21	20	21	22	23	25
3	30	25	25	22	20	22	22	24	26
4	27	24	24	22	21	23	24	27	28
5	31	26	26	24	23	24	27	28	29
6	31	27	27	24	22	23	24	25	27
7	30	26	26	24	23	24	25	27	28
8	27	25	25	22	21	22	24	26	27

2. **pH:** The pH of water ranges between 6.1 to 8.5. The Minimum pH was recorded in the winter season and it was highest in the summer season Bade et.al. (3) And Jyabhaye et.al. (6) Reported similar observation

pH									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	7.6	7.4	7.3	7.1	7.1	7.4	7.6	7.9	7.7
2	7.5	7.4	7.3	7.2	7.3	7.7	7.9	8.2	8
3	7.8	7.6	7.4	7.3	7.3	7.3	7.3	7.6	7.4
4	7.8	7.5	7.5	7.2	7.4	7.5	7.7	8.6	8.2
5	7.1	6.8	6.6	6.1	6.1	6.3	6.3	6.9	6.4
6	8.3	8.1	8	7.8	7.9	8.1	8.5	8.8	8.6
7	8.5	8.2	8.2	8	8.2	8.4	9	9.2	9
8	8	7.6	7.5	7.4	7.4	7.4	7.6	7.9	7.6

3. **Electrical conductivity:** The electrical conductivity of water ranges between 171 – 370 cm/second. The electrical conductivity shows variation in the reading.

Electrical Conductivity (cm/sec)									
Spots	Months								
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	240	234	230	226	220	224	240	246	250
2	200	190	188	182	171	172	178	180	180
3	320	315	310	302	298	306	308	320	340
4	250	245	240	230	228	230	234	280	290
5	350	346	344	340	336	342	348	360	370
6	330	327	322	320	312	312	313	320	350
7	330	326	324	320	312	320	324	335	340
8	325	320	315	312	306	310	318	330	340

4. **Total dissolved solid :** The total dissolved solids fluctuated between 108mg/L – 150 mg/L. Reading variations revealed that total dissolved solids values were maximum during monsoon and minimum during winter.

Total Dissolved Solids (mg/l)									
Spots	Months								
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	140	133	110	112	125	121	120	125	133
2	133	125	105	108	115	114	112	118	127
3	150	142	120	124	132	129	128	133	140
4	142	136	112	115	123	118	117	124	130
5	130	122	108	110	115	108	105	109	115
6	140	134	118	120	126	120	117	120	131
7	145	138	122	125	130	124	122	125	130
8	130	122	106	110	118	112	110	115	128

5. **Alkalinity** In present study the total alkalinity ranged between 178mg/l – 300mg/l. Total alkalinity found minimum in monsoon month and maximum in summer month during the study. Similar observations made by Bade et.al.(3), Nair (13) and Mane et.al.(12).

Alkalinity (mg/l)									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	252	263	255	252	265	272	280	295	300
2	182	198	182	178	180	185	192	198	200
3	264	272	268	264	275	285	298	302	310
4	245	256	246	242	254	262	270	284	290
5	208	215	200	196	206	213	225	232	240
6	225	232	225	220	230	248	260	272	280
7	206	218	206	200	204	218	225	232	235
8	205	215	205	202	208	215	230	240	250

6) **Total Hardness:** The total hardness of water is the sum of concentration of alkaline earth metal cations present in it.

Total hardness (mg/l)									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	115	122	130	134	132	132	134	136	136
2	113	124	132	136	132	137	139	142	142
3	105	116	124	130	128	134	134	137	137
4	103	114	128	135	134	134	136	137	139
5	104	114	120	126	122	125	125	128	131
6	93	102	114	121	119	122	126	130	134
7	88	100	112	122	120	126	132	137	140
8	94	108	122	135	132	137	139	142	142

7) **Chloride:** During the period of investigation chlorides in the water was ranged between 51mg / L -73 mg/L. The maximum values of chloride recorded in November month while in March less content of chloride was detected. Bade et.al. (3) Reported maximum values in winter and minimum values in summer season.

Chlorides (mg/l)									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	61	63	65	64	66	60	57	53	53
2	63	64	65	63	66	58	57	53	52
3	62	66	68	66	70	58	57	54	51
4	61	64	66	65	70	58	58	54	51
5	63	65	68	67	72	64	58	56	56
6	65	66	68	68	71	67	67	64	62
7	64	68	70	66	73	68	63	57	57
8	61	63	66	65	73	59	59	57	54

Turbidity : Turbidity was due to the presence of fine particles in the sample.

Turbidity (mg/l)									
Spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	220	240	230	215	198	190	185	178	170
2	250	260	255	250	242	230	202	193	180
3	204	220	215	209	205	196	188	178	170
4	240	250	235	225	213	206	193	180	165
5	260	265	255	235	218	192	165	150	145
6	225	238	220	218	216	212	208	192	185
7	230	240	230	222	218	204	192	178	165
8	210	235	230	208	206	200	188	171	150

10. Dissolved Oxygen: The values of dissolved oxygen ranged between 8.7mg/l - 10.8mg/l. The minimum dissolved oxygen was recorded in the summer month of March and greater in the range of winter. But it is maximum in the monsoon according to Deshmukh and Ambore. (4)Ahamed and Krishnamurti (1).

Dissolved oxygen (mg/l)									
spots	Months								
	July	Aug	Sup	Oct	Nov	Dec	Jan	Feb	Mar
1	9.2	9.9	10.2	10.4	10.4	10.3	9.8	9.5	9.4
2	9.3	9.8	10.1	10.3	10.3	10.2	9.9	9.3	9.3
3	9.2	9.8	10	10.3	10.2	10.2	9.8	9.5	9.3
4	9	9.6	10.2	10.5	10.5	10.2	10.2	9.8	9.5
5	9.4	10	10.3	10.8	10.8	10.4	10.4	10.2	10
6	8.8	9.4	9.8	10.6	10.5	10.4	10.4	10.4	10
7	8.7	9	9.4	9.9	9.8	9.8	9.6	9.5	9.5
8	8.9	9.5	10	10.5	10.5	9.8	9.4	9.2	9.1

IV. Discussion

The physicochemical parameters were studied: temperature, p^H , Dissolved oxygen, Alkalinity, Total Hardness, Total solids etc. Considering the hydro biological parameters Temperature is one of the important physical parameters directly related to chemical reactions in aquatic ecosystems. In the present study, the water temperature range was between 18°C to 29°C (Table 1), which is within the permissible limit of 40°C (IS 1981). Similar results were reported by Royee and Prakasam (2002). The change in atmospheric temperature with change in season brought corresponding change in water temperature. The difference in atmospheric temperature and water temperature is influenced by the high specific heat of water (Mishra and Patel 2001).

Temperature is known to play an important role in the productivity of water by influencing the abundance of primary producers. The p^H in the water of Bhima river ranges from 6.1 to 9.2. The low p^H may be due to the dissolution of acidic impurities, and such water is unsuitable for drinking (Jaysree 2002). The p^H more than 7 indicating an alkaline nature, which may be due to photosynthetic activity in the water body as reported by King (1970) and due to the presence of alkali and alkaline earth metals as reported by Mishra and Patel (2001).

The short and long term variations in the dissolved oxygen concentration in lakes, reservoirs, and streams give a good measure of their trophic state (Goldenman 1979). Based on hardness, water may be classified as soft and hard water. Hardness ranges from 0.0 mg/l to 130 mg/l. The present results showed that low values of hardness were recorded in summer and higher values were recorded in the winter season.

Chlorides in water are generally due to the salts of sodium, potassium, and calcium. Chlorides in natural water bodies may also be contributed by sewage discharge. The discharge of effluents from chemical industries, irrigation drainage etc. Fresh water contains 8.3 mg per liter of chloride in general.

Chourasia and Adoni(1985) stated that high concentration of chlorides in summer might be due to high evaporation rate, because of high ambient temperature and maximum human activities. In present study the high chloride values were mainly attributed to the animal and human activities. The variation in total phytoplankton population is seen due to the various physic-chemical parameters such as temperature, dissolved oxygen, hardness, alkalinity etc.

V. Conclusion

Hydro biological studies were carried out of various spots namely Kolpewadi, Chaskaman, Saygav , Donde, ETP, H.R.M. college, Brick factory and Chas during the period November 2013 to March 2014. The report presents the result of monthly variation of physic –chemical parameters, monthly variation of diversity and density zooplankton

The implementation of a biological criterion approach that directly measures biological integrity is, essential to account the status and trends in freshwater ecosystems. Freshwater ecosystem monitoring programs are usually long term, data intensive programs that establish points of reference for environmental conditions, and then attempt to document and identify change in these conditions over a long period of time. Long term examination of the above water quality parameters explained that, in general, the water quality of these river is not much better but after some primary treatment we can use these water for our different purposes.

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