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SEASONAL FLUCTUATIONS IN ABIOTIC COMPONENTS OF SABARMATI RIVER, GUJARAT, INDIA

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ABSTRACT

The study on some physico-chemical characteristics of River Sabarmati has been calculated for the period of one year (August 2011 to July 2012). The sampling points were selected on the basis of their importance. For surface water determination of water quality index becomes essential and pre-requisite. Analysis of some physico-chemical characteristics like water temperature, pH, transparency, dissolved oxygen, BOD, total hardness, alkalinity, Chloride, Nitrate and Phosphate has been done during the investigation period. Increase in temperature, pH, Transparency, Chlorides and Phosphates values were higher in Derol Station, whereas the increase in Total Hardness and Nitrates values were higher in Sapteshvarstation to the intensity of expulsion of contamination. The Total Alkalinity, Dissolved oxygen and BOD values higher in Valasana station owing to unpolluted water.

KEYWORDS : Water quality, DO, BOD, Sabarmati River

India is rich in its aquatic resources and high great variation in environmental conditions has a wide range of habitats. The most important natural gift for mankind in water which plays significant role in different vital and structural activities. The physico chemical characteristics are the most influencing parameters which affect the life in water world. Fluctuations in these constituents often create an adverse environment to organisms limiting their reproduction and interfering in the physiological processed which reduce their ability to compete with other populations. Assessment of water quality by its chemistry includes measures of many elements and molecules dissolved or suspended in the water and can be used to detect imbalances within the ecosystem. Such imbalances may indicate the presence of certain pollutants as suggested(Bhagavathi et al.,2001) . The commonly measure chemical parameters includes pH, alkalinity, hardness, nitrates, nitrites and ammonia, ortho and total phosphate and dissolved oxygen for Biochemical Oxygen Demand (BOD). Measurements such as conductivity and density in chemical measurement actually indicate the physical presence of pollutants in water .(Jammal,1998;Ellis,1937,Voelz et al.,2005)

The present study has been carried out to evaluate the physico-chemical parameter of river Sabarmati by using standard method, which enables the common man to understand the quality of water.

MATERIALS AND METHODS

The water samples for the physico-chemical analysis were collected in the first week of each month. The samples were taken each time between 7 .00-9.00 am from the four selected stations in the analysis of thephysico-chemical properties of water, standardmethod prescribed in limnological literature wereused. Temperature, Transparency, pH, DissolvedOxygen were determined at the site whileBiochemical oxygen demand, Chloride, Phosphate,Nitrate, Alkanity, Sulphate, Total Hardness weredetermined in the laboratory. The Physico-Chemicalparameters were determined by standard methods of APHA (2005); Golterman (1991) ;Dzerosi et al., (2002).

RESULTS AND DISCUSSION

The physico-chemical characteristics of the four samples points were given in Table 1, 2, 3 and 4 along with the respective values .

Temperature is an important biologically significant factor, which plays an important role in the metabolic of the organism. Temperature value was found to be ranging from 20°C to 43°C. An increase in the Temperature was observed at Derol (20°C to 43°C) further increased values could be noticed at Dharoi dam (25°C to 42°C) and Valasana (25°C to 40°C)) and Sapteshvar(22°C to 41°C)).

Lowest water temperature was observed in the

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Table 1: Physico-chemical characteristics of river Sabarmati at Dharoi dam for one year (August 2011 to July 2012)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	28	30	35	31	29	25	27	33	35	42	41	32
pH	9.1	8.7	8.2	8.5	7.61	7.84	7.8	8.2	8.1	9.2	9.22	9.11
Transparency (N.T.U.)	16	25	38	50.5	51.2	53	45	39	28	24	22	9.11
D.O. (Mg/l)	8.2	6.23	6.50	6.35	6.39	6.21	6.9	7.2	7.5	8.7	9.1	9.12
B.O.D. (Mg/l)	5.63	5.5	4.8	3.1	3.2	3.31	3.9	4.0	4.5	4.81	5	5.45
Total Hardness (Mg/l)	80	78	73	71	89	107	121	157	145	147	190	85
Alkalinity	245	255	230	250	235	250	245	264	258	298	300	278
Chloride (Mg/l)	49	38	0.3	25.4	21	26	36.5	39.1	46.7	49.1	53.4	53.1
Nitrate (Mg/l)	0.125	0.3	0.131	0.121	0.11	0.89	0.76	0.78	0.89	0.102	0.109	0.112
Phosphate (Mg/l)	0.46	0.49	0.5	0.16	0.17	0.21	0.23	0.27	0.31	0.35	0.42	0.45

Table 2: Physico-chemical characteristics of river Sabarmati at Valasana for one year (August 2011 to July 2012)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	27.1	30.1	35	31.3	29.2	25.2	29	33.3	34	40	35.1	31.2
pH	8.5	8.7	8.2	8.5	7.61	7.84	7.8	8.2	8.1	9.2	9.22	9.11
Transparency (N.T.U.)	20	30	42	55	48	58	45	36	28	22	20	12
D.O. (Mg/l)	6.2	9.2	9.8	6.5	7.2	7.5	8.1	7.3	6.4	5.7	4.9	5.4
B.O.D. (Mg/l)	6.3	5.7	5.08	3.0	2.8	3.1	3.8	4.3	4.7	5.1	5.5	5.7
Total Hardness (Mg/l)	128	136	170	165	155	180	188	200	170	210	205	166
Alkalinity	365	415	390	415	385	255	245	256	375	230	160	335
Chloride (Mg/l)	30	18	20	23	38	32	37	24	18	40	47	27
Nitrate (Mg/l)	0.120	0.135	0.139	0.120	0.110	0.890	0.765	0.780	0.850	0.115	0.190	0.122
Phosphate (Mg/l)	0.66	0.40	0.55	0.16	0.20	0.31	0.20	0.37	0.29	0.31	0.49	0.40

Table 3: Physico-chemical characteristics of river Sabarmati at Sapteshvar for one year (August 2011 to July 2012)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	25	31	33	32	28	22	26	33	35	41	39	30
pH	9.3	8.8	8.4	8.0	7.5	7.9	8.0	8.6	7.8	8.8	9.0	7.8
Transperency (N.T.U.)	19	28	40	55	52	58	42	37	22	20	24	15
D.O. (Mg/l)	7.8	6.50	6.25	6.65	6.89	6.10	6.90	7.50	7.10	8.90	9.30	8.80
B.O.D. (Mg/l)	5.63	5.5	4.8	3.1	3.2	3.31	3.9	4.0	4.5	4.81	5	5.45
Total Hardness (Mg/l)	115	125	165	188	165	190	205	235	210	245	215	170
Alkalinity	250	258	239	260	230	252	240	275	252	285	305	267
Chloride (Mg/l)	41	35	28	24	20	27	35	40	42	50	55	58
Nitrate (Mg/l)	0.140	0.125	0.135	0.115	0.105	0.095	0.076	0.070	0.890	0.125	0.119	0.122
Phosphate (Mg/l)	0.39	0.55	0.50	0.36	0.25	0.17	0.28	0.33	0.30	0.45	0.66	0.29

Table 4: Physico-chemical characteristics of river Sabarmati at Derol for one year

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	22	30	32	30	26	20	24	35	37	43	38	28
pH	9.0	8.2	8.8	8.4	7.9	7.5	8.5	8.9	7.2	8.0	9.4	7.7
Transparency (N.T.U.)	21	25	35	50	59	60	46	35	30	18	22	18
D.O. (Mg/l)	6.9	6.5	6.0	6.5	6.2	6.0	7.0	7.9	7.7	8.4	9.5	9.0
B.O.D. (Mg/l)	5.0	5.7	4.5	3.6	3.8	3.0	3.8	4.4	4.9	5.1	5.5	5.9
Total Hardness (Mg/l)	135	145	185	195	165	180	198	210	180	220	235	176
Alkalinity	220	245	220	230	210	245	260	287	260	299	315	255
Chloride (Mg/l)	50	45	39	32	28	36	48	55	60	69	56	43
Nitrate (Mg/l)	0.130	0.115	0.145	0.125	0.115	0.090	0.080	0.095	0.780	0.145	0.120	0.125
Phosphate (Mg/l)	0.55	0.75	0.69	0.45	0.39	0.25	0.30	0.39	0.44	0.57	0.86	0.49

Derol 20 °C. A study increase in water temperature in the course of River Sabarmati was noticed. There was an increase in water temperature after the discharge of the effluents into the river. An increase in temperature was observed from upstream station to lower . This might be due to mixing of the effluents. Our property of water is that with change in temperature, its density varies and it becomes less with warming up and more with cooling . The pH value was found to be ranging from 7.2 and 9.4. An increase in the pH was observed at Derol (7.2 and 9.4.) further increased values could be noticed at Dharoi dam (7.61 and 9.22) and Valasana 7.9 and 8.8 and Sapteshvar(7.5 and 9.3).

The River was found to be slightly alkaline at Derol minimum of pH value was noticed 7.2 and maximum value pH value was noticed 9.4. pH is one of the most important factors that serve as an index of the pollution. The pH values of majority reservoir in India have been found between 6 to 9. The higher range of pH indicates higher productivity of water. This corresponds with the work of . This pH range is also in agreement with the EPA international standard of fresh water. reported that water with a neutral pH value is conducive for the survival of most aquatic organism including macro invertebrates and fish.

The transperancy value was found to be ranging from 12.0 N.T.U to 60.0 N.T.U. An increase in the transperancy was observed at Valasana (12.0 N.T.U to 60.0 N.T.U.) further increased values could be noticed at Dharoi dam (15.0 N.T.U to 53.0 N.T.U.) and Sapteshvar15.0 N.T.U to 58.0 N.T.U. and Derol (18.0 N.T.U to 60.0 N.T.U. The mean value of transperancy in Dharoi dam 33.89 N.T.U and Valasana 34.66 N.T.U. and Sapteshvar34.33 N.T.U. and Derol 34.91 N.T.U. The transperancy value was ranging from 12.0 N.T.U to 60.0 N.T.U. Highest transperancy value was noticed at Derol 60.0 N.T.U and the lowest value was noticed at Valasana 12.0 N.T.U. i.e. recorded during the study period was similar to the range reported by The high value obtained (60 N.T.U.) could attribute to the discharge of animal wastes sewage, industrial wastes and urban runoff which creates a large amount of organic materials increased turbid condition.

The dissolved oxygen value was found to be ranging from 4.9 mg/l to 9.8mg/l. An increase in the dissolved oxygen was observed at Valasana (4.9 mg/l to 9.8 mg/l) further increased values could be noticed at Dharoi dam (6.21 mg/l to 9.12 mg/l) and Sapteshvar(6.10 mg/l to 9.30 mg/l) and Derol (6.0 mg/l to 9.5 mg/l). Dissolved oxygen is an important parameter of the river, which is essential to the metabolism of all aquatic organisms . Dissolved oxygen plays an important in water quality determination. Particular water body is greatly influenced by temperature photosynthetic activity and respiration . The Dissolved oxygen percent saturation was low at Valasana.

This is due to the addition of bleaching and dying effluents containing oxidisable organic matter and consequent biodegrading and decay of vegetation, which leads to consumption of oxygen present in water .which tallies with the research finding of .

The biochemical oxygen demand (BOD) value was found to be ranging from 2.8mg/l to 6.3mg/l.An increase in the BOD was observed at Valasana (2.8 mg/l to 6.3 mg/l) further increased values could be noticed at Dharoi dam (3.1 mg/l to 5.63 mg/l) and Sapteshvar(3.1 mg/l to 5.63 mg/l) and Derol (3.0 mg/l to 5.9 mg/l). Pointed out that the minimum oxygen content in water for maintaining fish life healthy condition. An increase in the BOD was observed at Valasana (2.8 mg/l to 6.3 mg/l). This range is contrary to the BOD range value of EPA international standard of fresh water. According to EPA, the BOD standard for fresh waters of unpolluted rivers is less than 5.0mg/l. the high level of BOD might have been attributed to the discharge of pollutants into the river through washing, sewage contamination, industrial affluent and a like.

The Total Hardness in water depends on the presence of principle cations Ca++ and Mg++. The Total Hardness value was found to be ranging from 71mg/l to 245mg/l.An increase in the Total Hardness was observed at Dharoi dam (71mg/l to 245mg/l) further increased values could be noticed at Valasana (128 mg/l to 210 mg/l) and Sapteshvar(115 mg/l to 245 mg/l) and Derol (135 mg/l to 235 mg/l).

Alkalinity is not a pollutant. It is a total measure of the substances in water that have acid-neutralizing ability. Alalinity value was found to be ranging from 160mg/l to 415mg/l. An increase in the Alalinity was observed at Valasana (160 mg/l to 415 mg/l) further increased values could be noticed at Dharoi dam (230 mg/l to 300 mg/l) and Sapteshvar(230 mg/l to 305 mg/l) and Derol (210 mg/l to 315 mg/l). Alkalinity is important for fish and aquatic life because it protects or buffers against pH changes and makes water less vulnerable to acid rain.

Chloride is a material that is both a natural component of water in northeast Ohio and also a very common industrial material. It enters rivers from industrial processes, domestic sewage, and surface runoff. Chloride value was found to be ranging from 0.3mg/l to 69mg/l. An increase in the Chloride was observed at Dharoi dam (0.3 mg/l to 69 mg/l) further increased values could be noticed at Valasana (18 mg/l to 43mg/l) and Sapteshvar(20 mg/l to 58 mg/l) and Derol (28mg/l to 69 mg/l). The mean value of Alalinity in Dharoi dam 36.46 mg/l and Valasana 29.5 mg/l and Sapteshvar37.91 mg/l and Derol 46.75 mg/l. Chloride is often termed a conservative pollutant. That is, it does not react as readily as many other materials in the water; nor does it settle out as readily. As a result, it is often a very good indicator of the aggregate amount of anthropogenic materials dumped into the river from all sources .

Nitrate is the number one limiting factor that prevents the completion of this cycle. Nitrate value was found to be ranging from 0.070mg/l to 0.890mg/l. An increase in the Chloride was observed at Sapteshvar(0.070 mg/l to 0.890 mg/l) further increased values could be noticed at Dharoi dam (0.11 mg/l to 0.131mg/l) and Valasana (0.110 mg/l to 0.890 mg/l) and Derol (0.080mg/l to 0.780 mg/l). The mean value of Nitrate in Dharoi dam 0.355 mg/l and Valasana 0.316 mg/l and Sapteshvar0.176 mg/l and Derol 0.172 mg/l. Nitrates are directly useable by living organisms, and are an essential macronutrient in aquatic ecosystems.

Phosphate is the most important factor in the cultural eutrophication of rivers and streams throughout the world. Phosphate value was found to be ranging from 0.16mg/l to 0.86mg/l. An increase in the Phosphate was observed at Derol (0.25 mg/l to 0.86 mg/l) further increased values could be noticed at Dharoi dam (0.5 mg/l to 0.49mg/l) and Valasana (0.16 mg/l to 0.66 mg/l) and Sapteshvar(0.17mg/l to 0.66 mg/l). Phosphates stimulate the growth of plankton and water plants that provide food for fish. Phosphates come from fertilizers, Pesticides, industry and cleaning compounds. Natural sources include phosphate- containing rocks and solid or liquid wastes. This may increase the fish population and improve the waterway's quality of life. If too much phosphate is present algae and water weeds grow wildly, choke the waterway, and use up large amounts of oxygen. Many fish and aquatic organisms may die.

CONCLUSION

The assessment of water quality at Sabarmati river for a period of One Year via physicochemical analysis indicated that the temperature, pH and Transparency lies within the standard limit of good water quality set for freshwater according to EPA and WHO, while dissolved oxygen concentration and Biochemical oxygen demand recorded have exceeded the minimum standard values limit set by EPA and WHO . There is therefore a need of for a regular monitoring of the water to reduce the pollution level.

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