Physico-chemical Analysis of Pravara River water and its Impact on Human Health in Sangamner Tahashil (Maharashtra)

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ABSTRACT

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Water samples were collected from five different stations during pre monsoon season in Sangamner tahasil, Ahmednagar district. Different physicochemical parameters were measured and the samples were also analysed. Physicochemical parameters included pH, temperature, total alkalinity, total dissolved solids, electrical conductance (EC) bicarbonate, calcium, magnesium, Sodium etc. The quality of water play an important role concern to human being .Water covers 71% of Earth's surface and is vital for all known forms of life Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Natural water, whether in the atmosphere, on ground surface, or under the ground, always contains dissolved minerals and gases as a result of its interaction with the atmosphere, minerals in rocks, organic matter, and living organisms. Reservoirs are one of the most important water resources used for water supply and irrigation. The results obtained from chemical analysis were compared with three standards namely BIS, WHO and ISI. Effect of industrial waste, municipality sewage and agriculture runoff on the river water were investigated . It is found that this water body is not suitable for drinking .so possible remedial methods should be adopted for this water resource for improving its quality.

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I. INTRODUCTION

The increasing industrialization, urbanization and developmental activities and consequent pollution of water is of major concern. Today most of the rivers of world receive millions of litres of sewage, industrial and agricultural leachates containing substances

varying in characteristics from simple nutrients to highly toxic / hazardous substances. The fate of ground waters is also same in most of the areas. The cities and industries continue to be the most significant causes of pollution of aquatic ecosystems due to a diverse kind of wastes produced (Trivedy and Goel, 1984). The pollution problems in industrial

areas are significant. Temperature, PH, turbidity, electrical conductivity, are the most important physico-chemical properties of water (APHA1992)

Hydrochemistry is an important aspect of ground water in order to know its use for domestic irrigation and Industrial purpose .Analysis of water and its interpretation and assessment will determine the various uses of ground water Soil and water are important abiotic factor of environment. Water is the most vital resource for all kinds of life on the planet, adversely affected both qualitatively and quantitatively by human activities on land, in air or in water.

Therefore, the main objects of the study to water samples were analysed. The physico-chemical parameters viz hardness, amount of various ions in water, pH, chloride, carbonate, bicarbonate, sodium, calcium, magnesium. Seven water samples from ten different sites were analysed.

VI	Near Rajhanse dairy	Industrial waste , car and animal wash, Domestic waste sources
VII	Paper mill area	Industrial waste , car and animal wash, Domestic waste sources
VIII	Velhale village	Agricultural runoff ,Domestic waste sources
IX	On the way of Rajapur	Industrial waste , car and animal wash, Domestic waste sources
X	Near Agneshwar temple	Industrial waste , car and animal wash, Domestic waste sources

Table 1. Sampling station in Pravara river

Sampling site no.	Location sampling sites	Description
I	Sangvi near the bank of pravara	Agricultural runoff sources
II	On the way of pemgiri	Agricultural runoff sources
III	Near datta temple	Domestic wastes and Agricultural runoff sources
IV	Gavali mala	Agricultural runoff sources
V	Pravara pul	Domestic wastes and Agricultural runoff sources mulcipality waste , car and animal wash ,industrial waste

II. METHODS AND MATERIAL

Sangamner area is located in the northern part of the Ahmednagar district of Maharashtra State. The Sangamner tahsil lies between 180 36' N and 1901' N latitude and between 740 1' W and 740 56' W longitude

The Sangamner town is located on the confluence streams of Pravara and the Mhalungi rivers , which is at a distance of 150 km from Pune, on Pune-Nasik National Highway No. NH-50. The area is drained by the Pravara river, which originates in the hilly region of Western Ghats at Ratangarh. Geologically, basalts underlay the Pravara basin. In general the climate is dry and hot the average maximum temperature during summer is as high as 42°C in month of May and average minimum temperature falls up to 10° C during the month of December. , annual rainfall ranging from 290 to 594 mm.

The water samples were collected randomly from ten different stations during pre monsoon season. In the present study, water samples were collected from ten different locations of Pravara river of Sangamner city in Ahmednagar district ., namely S-I (Sangvi near the bank of Pravara), S-II (On the way of pengiri), S-III (Near datta temple), S-IV (Gavali mala), S-V (Pravara pul), S-VI (Near rajhanse dairy) S-VII (Paper mill area) ,S-VIII (Velhale village) ,S-IX (On the way of rajapur) S-X (Near Agneshwar temple) for physico-chemical analysis. Water samples were collected from sampling sites pre monsoon, (WHO 2004,2009)

The water samples were brought for the estimation of various Physical and chemical parameters . Physical parameters tested were pH, temperature ,colour and turbidity rabidity should be less than 5.0 Nephelometric Turbidity Units and pH should be less than 8 Chemical parameter electrical conductivity, Total Dissolved solids (TDS), calcium, magnesium ,

carbonate , bicarbonate sodium and chloride . The pH and turbidity were measured and estimated at sampling sites by using water analysis kit.

For physico-chemical analysis, water samples were collected in one litre polyethylene bottle.

Determination of water quality parameters

The analysis of various physico-chemical parameters namely pH, Temperature, Turbidity, Colour, Total Dissolved Solids (TDS), Total Hardness (TH), Calcium Hardness, magnesium and Alkalinity. The standard methods APHA et al (1995) were adopted for analysis of water. Temperature and pH were measured at the time of sampling itself.

The standard limits of water quality parameters in drinking water prescribed by WHO, BIS , ISI, ICMR, and is shown in the Table 2

Table 2. The standards for physical and chemical quality of drinking water.

Water parameter	WHO		BIS		ISI		ICMR	
	HDL	MPL	HDL	MPL	HDL	MPL	HDL	MPL
P ^H	7-8	6.5-9.5	7.0-8.3	8.5-9.0	6.5-8.5	8.5-9.5	7.0-8.5	6.5-9.2
Temp.0 0 c	-	-	-	-	-	-	-	-
Turbidity(NTU)	5	25	5	10	10	25	5	10
colour	-	-	-	-	-	-	-	-
TDS mg ⁻¹	500	1500	500	2000	500	1500	500	2000
Calcium (mg/L)	75	200	-	--	75	200	-	-
Magnesium(mg/L)	30	150	-	-	30	100	-	-
TH (mg/L)	100	500	200	600	300	600	300	600
Alkalinity (mg/L)	200	600	175	550	200	600	-	-

MPL (Maximum permissible limit), HDL (Highest Desirable level) , ISI (Indian Standard Institute), ICMR (Indian Council of Medical Research), BIS (Bureau of Indian Standard), WHO(World Health Organization) .

Table 3 : Analysis of various physic- chemical parameters at sampling sites

Parameter	Collection stations									
	S-I	S-II	S-III	S-IV	S-V	S-VI	S-VII	S-VIII	S-IX	S-X
p ^H	7.82	8.27	8.17	8.15	8.31	8.45	8.7	8.19	8.55	8.39
Temp. °c	28.5	29.7	28.2	26.6	28.6	28.7	29.2	30.1	29.4	28.9
Turbidity	3.5	4.3	5.9	5.2	5.6	3.9	5.5	5.6	6.4	5.5
Colour	clear	clear	clear	clear	clear	clear	brown	clear	brown	brown
EC dSm ⁻¹	0.65	0.69	2.94	3.67	0.85	1.89	2.46	2.2	1.26	1.26
TDS mg ⁻¹	416	443.7	1883	2348.8	544	1121	1469	1408	804.3	780.9
CO ₃ ²⁻ me ⁻¹	Ab	Ab	Ab	Ab	Ab	Ab	Ab	Ab	Ab	Ab
HCO ₃ ⁻ me ⁻¹	11.2	8.37	4.77	4.33	11.4	3.4	16.2	15.9	4.23	4.97
Ca ⁺⁺ me ⁻¹	7.63	8.36	7.06	9.43	11.4	4.97	14.1	15.5	12.3	4.83
Mg ⁺⁺ me ⁻¹	12.3	3.33	7.43	7.93	4.53	5.5	12.83	5.77	5.83	9.07
Na ⁺ me ⁻¹	9.86	12.19	39.19	39.87	27.4	16.1	23.08	14.34	16.71	13.71
Cl ⁻ me ⁻¹	13.8	9.36	18.6	35.3	14.7	28.1	25.63	16.9	16.87	13.9

III. RESULTS AND DISCUSSION

1. pH

As per BIS pH of drinking water should be between 6.5 to 8.5. If the pH of water goes below 6.5 to 8.5 leads to harmful effects. Maximum p^H (8.27) and (8.31) found in water sample collected from S-II and S-V. while lower in S-I(7.82), S-III(8.17) and S-IV(8.15). It is observed that, the p^H of water remain alkaline. The variation in pH of irrigation water were associated with source, quality and quantity of irrigation water used, types and quantity of fertilizer added and cropping pattern followed WHO, BIS, ISI, ICMR proposed at desirable range of 6.5 to 8.5 for pH of drinking water (BIS,1991,2004,2005) but greater than 8.6 except S- VII and S- X. Sampling sites pH is

one of the most important operational water quality parameters. The value of pH at ten sampling sites are shown in fig 1.

2. Temperature

The temperature values at ten sampling sites are shown in fig 2. The temperature of collected water samples varies in between 28 to 30 °C at all water sampling sites pre monsoon. No health based guidelines are proposed for temperature by WHO, BIS, ISI, ICMR.

3. Turbidity

The turbidity values at ten sampling sites are shown in table 3. No health based guidelines are proposed for temperature by WHO, BIS, ISI, and ICMR. The temperature of collected water samples varies in between 5 to 10 at all water sampling sites pre monsoon.

4. Colour

The water samples are generally coloured due to presence of colloidal, inorganic, impurity, decomposition of vegetation. The water samples collected was found to be colourless and some are brown colour because of industrial effluent percolate well.

5. Electrical conductivity

The electrical conductivity of water were low and within safe limit (1.75 dSm⁻¹). The electrical conductance values at ten sampling sites are shown in fig 3.

6. Total Dissolved solid

The highest total dissolved solids value were found in a water sample collected from S-IV (2348.8 mg/l) and S-III (1883.0) while the water. The quantity of TDS was proportional to the degree of pollution (Rain et al. 1990, Nasrullah 2006).

Samples collected from S-I, S-II, S-V lower in order i.e. 416, 443.73, mg/l. The TDS values at ten sampling sites are shown in fig 4. The higher dissolved solid was due to excess use of irrigation water in irrigation area. This is because of addition of solids from open domestic sewage, agriculture runoff sewage coming from sewage pipes and untreated or inadequately treated effluent discharged from different types of industrial units. The TDS values at ten sampling sites are shown in fig 4. WHO, BIS, ISI, and ICMR

proposed a desirable range of 500 mg/L for TDS of drinking water. The TDS value are greater than 544 mg/L except S-I and S-II sites.

7. Alkalinity (Carbonate and bicarbonate)

Alkalinity is due to the presence of bicarbonate, carbonate which dissolve in water from soil. WHO, BIS, ISI, and ICMR proposed a desirable range of Alkalinity of drinking water.

The carbonates were absent in the irrigation water from all the water samples of experimentation.

8. Calcium Hardness

Calcium is play important role in bone structure, blood clotting. Some 99% of body calcium is in the bone, which 40% calcium (WHO 2009). However, values exceeding 25 mg/l of calcium in drinking water have human health implication, according to WHO 2004 guideline. The calcium values at ten sampling sites are shown in fig 5.

The highest calcium value was found in water sample collected from S-V, which was 11.43 me⁻¹ but the water sample collected from S-I, S-II and S-III were lower in order shows 7.63, 8.36, and 7.06 me⁻¹ respectively. WHO, BIS, ISI, and ICMR proposed a desirable range of 75 mg/L for calcium hardness of drinking water. The calcium hardness value at all the sources of well within the WHO, BIS, ISI, and ICMR desirable limits.

9. Magnesium

The highest magnesium value was found in water sample collected from S-I which was 12.33 me⁻¹ but the water sample collected from, S-III, S-IV and S-V are lower order showed that 7.43, 7.93, and 4.53 me⁻¹ respectively. The lowest magnesium value from S-II is 3.33 me⁻¹. The magnesium values at ten sampling sites are shown in fig 6.

The total hardness is mainly due to Ca, Mg (Sharma 2001, De1994). The water containing excess hardness is not desirable for potable water. WHO, BIS, ISI, and ICMR proposed a desirable range of total hardness of drinking water. Total hardness values all the sources of well with in the WHO, BIS, ISI, and ICMR desirable limits.

The highest chloride value was found the water sample collected from S-IV, which was 35.3 me⁻¹ but the water sample collected from S-I, S-II, S-III and S-V are lower in order shows that 13.8, 9.36, 18.6, 14.7 me⁻¹ respectively

Sodium is essential element require for normal body function including muscle contraction and relaxation how ever in excess amount of sodium increases individual risk of hyper tension, heart disease. The highest sodium content was found in a water sample collected from S-III and S-IV, which is 39.19, 39.87 me⁻¹ But S-I and S-II are lower order shows 9.86 and 12.19 me⁻¹.

The calcium, magnesium, sodium, and chlorides of water from area were within safe limit. So the water from the collection centre is fit for drinking purpose.

IV. CONCLUSION

Water must not be used for drinking purposes without proper treatment. The Pravara river is one of the most important river of Sangamner that city. The sources of pollutants are local open domestic sewage, sewage coming through sewerage pipes, agricultural runoff containing fertilizers, pesticides, and insecticides. The physicochemical parameters (pH, temperature, turbidity, colour, total dissolved solids (TDS), carbonate, calcium hardness magnesium, and alkalinity) at all the sampling sites in the study area were within the limits. Recommendation of drinking water is drainage lines are laid on the opposite sides of the river to avoid pollution and Water must not be used for drinking and irrigation purposes without proper treatment.

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