



Physiochemical Analysis of Freshwater-Bodies of Solapur

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Abstract

The around seven rivers running all over the Solapur district and provide water for irrigation, industrial and household purposes. The biochemical analysis of river water indicates that the river water is alkaline in overall Solapur district which comes around an average pH 8.5. Along with the pH around 11 parameters were tested with respect to river waters and we found variations in each parameter. The parameters investigated in the present study are electrical conductivity, total hardness, sulfate, calcium, magnesium, total dissolved solids (Total suspended solids and total solids), nitrate and dissolved oxygen. The present study was primarily focused on the testing of freshwater quality in Solapur city. Based on the survey above sampling sites were selected. The samples were analyzed for physical-chemical parameters following the procedures prescribed in standard methods for the analysis of water and wastewater.

Keywords

Physiochemical, water bodies, Solapur.

INTRODUCTION

Rivers are the natural habitats for aquatic life and very important components for human beings. Ponds have been used since time immemorial as a traditional source of water supply in India. A pond is referred to as a man made or natural water body. This is between 1 m² and 2 ha area, which holds water for four months of the year or more. The water of ponds is polluted mainly due to discharged wastewater from residential areas and sewage outlets.

Nowadays, in the name of development, there is an occurrence of rapid urbanization, industrialization, and extensive applications of chemical in agricultural activities etc. The wastewater released from the domestic waste, treated and untreated effluents of industry and agricultural runoff contains high amount of pollutants. These pollutants deteriorate the water quality and are the major source of pollution in the river, stream, canal, pond etc. Hence water quality is an important aspect to evaluate the sustainability and suitability of water for aquatic

organisms and human beings. The quality of water depends on its uses, and it can be assessed by the analysis of physicochemical parameters of water. Water quality parameters in rivers have been investigated by numbers of investigators.

Therefore, the present investigation has been carried out with the objectives to assess the water quality status based on some physicochemical characteristics of different water system such as river, pond of Solapur District of Maharashtra State located at different elevation.

MATERIALS & METHODS

Study Area

Solapur (Latitude: 17.6599° N; Longitude: 75.9064° E) is a district in Maharashtra State of India and have Arid/Semi-arid climate with average temperature ranging from 25°C- 40°C and an annual rainfall as 545 mm. The district has a total geographical area of 180.67 sq.km and is characterized by four river systems namely- Bhima, Sina, Bhogawati, Nira and

major pond systems namely – Sambaji Talav, Ekruk lake, Siddheshwar Talav, Hotagi Talav.

Sample Collections

Natural water samples were collected from different seven locations covering the area of Solapur city. Collected samples from selected sampling sites were further analyzed to find the quality of water. Samples were collected in good quality of screw capped polyethylene bottles of 1000 ml capacity. The sampling was done without addition of any preservatives in bottles.

Physiochemical Characterizations

The collected samples were further characterized for the parameters like pH, TS, TDS, TSS, DO, calcium, magnesium, sulphate, nitrate, and total hardness by using standard methods within 24 hours of sample collections.

RESULTS

pH

It is used to express the intensity of acidic or alkaline condition of the solution. Most of the water

resources are slightly basic. WHO has recommended maximum permissible limit of pH 6.5 to 9.2 for surface water. At all seven sampling sites pH values were recorded in the range of 8.4 to 8.6, which comes within the recommendations of WHO. The pH controls the chemical state of many nutrients, including dissolved oxygen, phosphate, nitrate, etc. (See Figure 3)

Electrical Conductivity (EC)

Electrical conductivity is a measure of water's capacity to convey the electric current. It signifies the total number of dissolved acids, and it is to be recorded from all sampling locations around in the range of 0.8 – 3.0 S/m.² (See Figure 3)

Total Hardness

Hardness is the property of water which increases the boiling points of water and indicates the presence of heavier salt in it such as calcium or magnesium salts or both. The values of hardness recorded in the range of 180 mg/L to 620 mg/L from all sampling sites and which comes above the recommended limits of WHO.³ (See Figure 1)

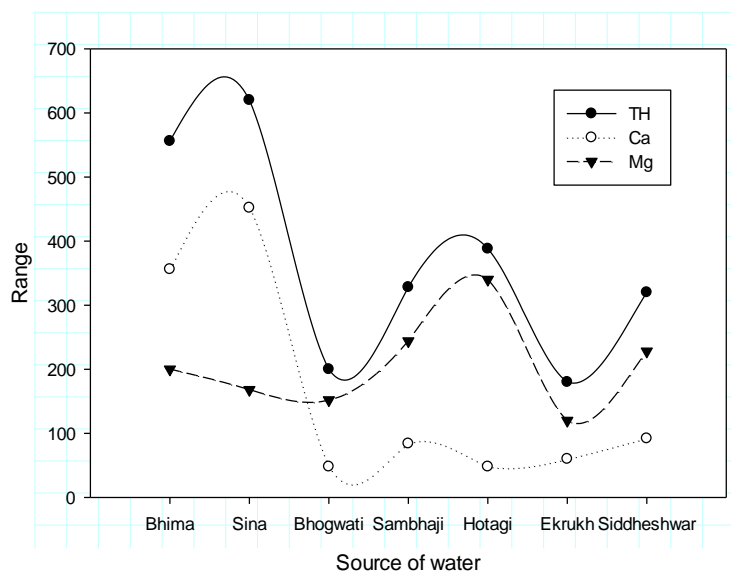


Figure 1 – Different water sample collection sites in Solapur District and their TH, Ca, Mg levels

Sulfate

Sulfate is a nontoxic anion but ailments like catharsis, dehydration and gastrointestinal irritation have been linked to it when concentration is high. Concentration of sulfate in water sample ranged from 0.411 mg/L to 4.525 mg/L. And all values found in within the limit of WHO.⁴ (See Figure 3)

Calcium & Magnesium

The Hardness is directly related to Calcium and Magnesium content. In the present study, the Calcium concentration ranged between 48 mg/L to 452 mg/L and found above the permissible limit of

WHO. While Magnesium content in the water samples ranged from 120 mg/L to 340 mg/L which was found above the prescribed limit.³ (See Figure 1)

Total Dissolved Solids (TDS)

TDS is the presence of dissolved solids, and it indicates the behavior of salinity in the water sample. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/L is also allowed. TDS values varied from 18 mg/L to 37 mg/L. The all-TDS values were lower than the prescribed limit of WHO.⁵(See Figure 2 and 3).

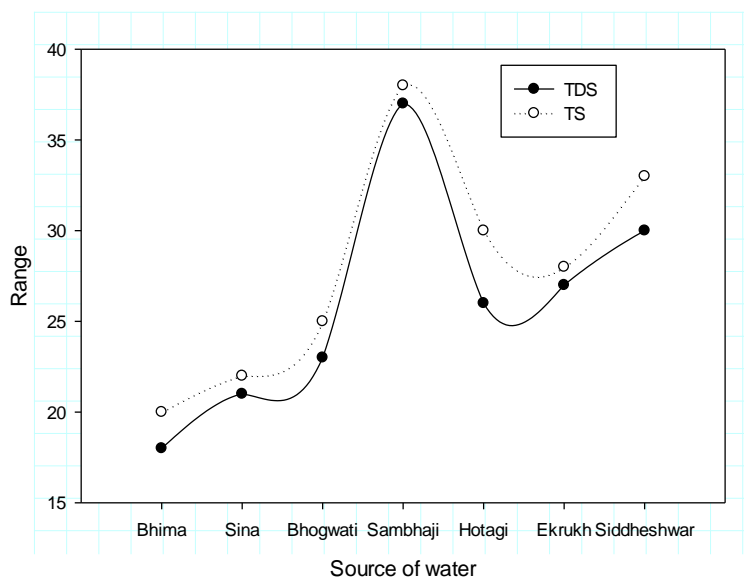


Figure 2 - Different water sample collection sites in Solapur District and their TDS and TS levels

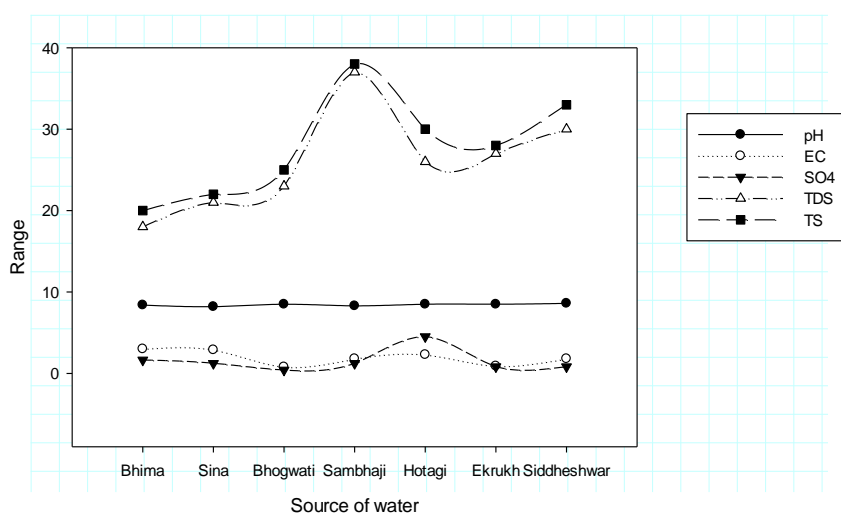


Figure 3 - Different water sample collection sites in Solapur District and their pH, EC, Sulphate, TDS, and TS levels

Nitrate

Nitrate and nitric ions are important indicators of Pollution by organic material as Nitrogen from decomposing Organic Substances often ends as difficult because of low level found and distinct possibilities of interfering material being present. Nitrate levels in drinking water are usually below 0.1mg/L. Nitrate values varied from 3160 mg/L to 6970mg/L⁶

Dissolved Oxygen (DO)

DO levels in water and wastewater depend upon physical, chemical, and biological activities in water. The solubility of atmospheric O₂ in freshwater ranges from 14.6 mg/L at 0°C to above 7mg/L under normal atmospheric pressure⁷

Sambhaji and Ekrukh, Hotagi and Siddheshwar are city ponds; Bhima, Sina and Bhagwati are the rivers running in that area.

Bhima, Sina and Bhogwati are around the farmlands. The hardness of water is supposed to be because water runoff along with synthetic fertilizers and pesticides. The Sambhaji is a natural pond while Siddheshwar is an artificial pond where there is discharge of household wastewater such as treated sewage. Sambhaji is a natural pond.

DISCUSSION

Water samples have been collected from different sites of waterbodies in Solapur District, the total area which covers around 180.67 sq.km. The climatic environment present in this region is Arid / Semi-Arid

with average temperature ranging from 25 °C – 40 °C with annual rainfall of 545 mm. The region receives water from Sahyadri Ranges, which comes with enormous amount of minerals and salts resulting in alkaline soil in the environment of Solapur. It was thought that the soil of Solapur originated by Volcanic eruptions, hence we detected higher concentration of ions like Sulphate, Magnesium, Calcium and Nitrate. In our study we observed that the water sample from each site shows strong alkaline pH and presence of Ca and Mg makes it very

Hard and not potable. The concentration(s) of DO (Dissolved Oxygen) were found to be very low in collected samples, the reason for higher concentration(s) of ions and low DO Concentrations may be because of drain off water coming from nearby Agricultural land. Probably the agricultural land having higher concentration of synthetic fertilizers and pesticides which makes the concentration of ions in waterbodies very much high. (See Supplement 1).

Supplement 1 – Different Parameters measured in different water bodies of Solapur District

Sr.No.	Parameter	Prescribed Standard	Bhima	Sina	Bhogwati	Sambhaji	Hotagi	Ekrukh	Siddheshwar
1	pH (at 35°C)	6.5 – 8.5	8.4	8.2	8.5	8.3	8.5	8.5	8.6
2	EC (mS)	0.8 – 2.5	3.0	2.9	0.8	1.8	2.3	0.9	1.8
3	Total Hardness (mg/L)	110 – 300	556	620	200	328	388	180	320
4	Sulfate (mg/L)	0 – 630 (R) 2 – 250 (L)	1.645	1.233	0.411	1.233	4.524	0.822	0.822
5	Ca (mg/L)	100 – 200	356	452	48	84	48	60	92
6	Mg (mg/L)	10 – 100	200	168	152	244	340	120	228
7	TDS (mg/L)		18	21	23	37	26	27	30
	TS (mg/L)	30 - 6000	20	22	25	38	30	28	33
	TSS (mg/L)		2	1	2	1	4	1	3
8	Nitrate (mg/L)	0 – 18	4.46	6.97	4.46	4.5	3.16	4.38	4.07
11	DO (mg/L)	6.5 - 8	1.95	3.26	4.89	9.12	0.65	0.97	0.10

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