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Studies on Physico-Chemical parameters of water samples in Shivamogga area, Karnataka

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ABSTRACT

Water samples were collected for physico-chemical analysis from different areas of Shivamogga district , Karnataka. The water samples were analysed for various parameters such as pH, EC, salinity, total alkalinity, total dissolved solids, chloride, iron, fluoride, total hardness, BOD and dissolved oxygen. By comparing the results against drinking water quality standards laid by WHO, it is observed that water samples from these areas are potable for human consumption after treatment due to moderate levels of physico-chemical parameters.

1. Introduction

Water is an elixir of life and is a primary need of all the living beings. It is a valuable commodity available in very limited quantities to man and other living organisms. Lentic water body may have been natural water sources exploited by man at different time to meet different needs or may have been created for a multitude of different purpose (Rajagopal *et.al*., 2010). Physico-chemical criteria are developed on the basis of scientific information about the effects of pollutants on a specific usage of water (Rashmi *et.al*., 2013).

The environment effect of chemical components can be considered to be a disturbance in ecosystem in terms of an increase in concentration of ion or organic compounds beyond their natural level in plant and animal kingdom. (Holdgate, 1983; Rathore *et.al*.,1996). The article summarises the physico-chemical data and important discussion in the distinct water sample of Shivamogga district.

2. Materials and Methods

Study Area

Shivamogga lies between the latitudes 13°27' and 14°39' N and between the longitudes 74°38' and 76°04' E at a mean altitude of 640 metres above sea level (National Informatics Centre,2007). Present study was carried out from January to December 2016. The important crops grown in this region are paddy, arecanut, coconut, sugarcane, maize etc. The peak Kodachadri hill at an altitude of 1343 metres above sea level is the highest point in this district. Rivers Kali, Gangavati, Sharavati and Tadadi originate in this district. The two major rivers that flow through this district are Tunga and Bhadra which meet at Koodli near Shimoga city to gain the name of Tungabhadra, which later joins River Krishna.

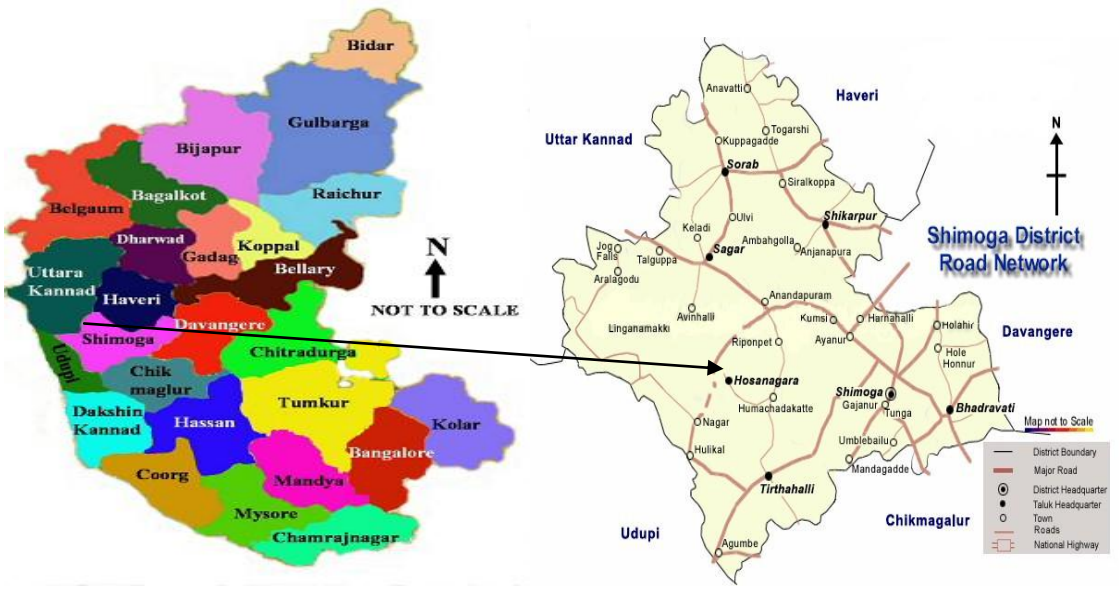

Figure 1 : Study area map (Source:go2india.com;www.veethi.com;en.wikipedia.org)

Experimental

All the chemicals were used of analytical grade. The conductivity was measured with the help of conductivity meter. Digital pH meter was used to determine the pH of each sample. Dissolved oxygen was measured with Winkler's method. The remaining water quality parameters were measured as per the standard methods of APHA (1995) and Trivedy and Goel (1986).

Table 1 depicts the methods for determination of water quality parameters and Table 2 shows the Indian standards for drinking water quality.

3. Results and Discussion

Drinking water samples of Shivamogga region were physico-chemically analysed. Table 3 & 4 summarises the result of some physico-chemical data for the collected water samples.

pH values were found in the range of 6.9 to 7.8. Electrical conductivity was obtained in the range of 16 to 242 μmhos/cm. Dissolved oxygen was found to varied from 2.6 to 4.4 mg/l Salinity and TDS are the most important parameter for irrigation water, since it controls the availability of water to plants through osmotic pressure regulation mechanism. The high value of salinity obtained at Harige area. This might may be appropriate for the cultivated land and almost agriculturist at this area. The low alkalinity was obtained at Harige and industrial area it attributes to the flushing (Nurhberg, 1977).

The total hardness obtained i.e., 140 mg/l suggesting this water may be fruitful for citizens of Shivamogga district in the crisis provided that 15 kms. Chloride content was very high in industrial and Harige area (Rathore and Lavale, 1994).The upper permissible limit for chloride in both drinking and irrigation water is 600 mg/l according to ISI (1974). Low chloride content in water is an indicator of low organic waste materials.

Nevertheless, fluoride values were moderate which has a special significance in teeth decay and pyorrhoea. Nitrate is the oxidised form of nitrogen and in water its most important source of biological oxidation of nitrogenous organic matter of both autochthonous and allochthonous origin. Nitrate level was found in the range of 0.6 to 0.89 mg/l. Even though, it is an important plant nutrient, the low value indicating the prevention from blue-body syndrome as it did not exceed to 40 mg/l. Iron was found in all natural water both in oxidised and reduced form.

The iron content deviated from 0.36 to 1.98 mg/l. Rain water contains about 0.6 mg CO_2 per litre. In this study, the CO_2 level obtained in the range of 10 to 22 mg/l. It attributes to the fact that the ground water is extra rich in CO_2 when precipitated water percolates through the soil, additional CO_2 is dissolved out of soil air (De, 1985).

Respiratory activity of aquatic organisms and the process of decomposition are important sources of CO_2 in bodies of surface water. CO_2 forms carbonic acid (H_2CO_3). Water containing free CO_2 reacts with limestone of soil, producing readily soluble calcium bicarbonate (C_aHCO_3)

The reactions are continue until the equilibrium between bicarbonate, carbonate and CO_2 is established. At varying pH, different proportions of these species of CO_2 present. At pH>8 because of concentration of free CO_2 is negligible, the bicarbonate begin to decompose and precipitate as CO_3. At pH 0 to 6.5 almost all the species of CO_2 are present in the form of carbonic acid. $10.5 < pH > 6.5$ in the form of HCO_3 and at $14 > pH < 10.6$ in the form of CO_3. Free CO_2 dissolved in water is the only source responsible for photosynthetic activity of aquatic plants (Rathore et al.,1996).

Biochemical oxygen demand values ranged from 0.8 to 3.80 mg/l. Biochemical oxygen demand values were low; this is because the temperature retards the rate of reproduction of organisms. Similar observations were also made by Mane and Madlapure (2002) from Manar river district Nanded

4. Conclusion

The data of physico-chemical parameters under study exhibits that the degree of pollution is less in the water samples and the evaporation rate is higher in summer months. In the light of standard of water quality recommended by WHO and BIS, the water samples should be used by human beings especially for drinking and cooking after treatment. From the present investigation, it may be concluded that the physico-chemical characteristics of the water indicates that they are moderate nutrient rich water samples from different areas of Shivamogga district and there is an urgent need of preventive measures.

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Tables

Table 1: Method of determination of water quality parameters

Sl. No.	Parameters	Methods
1	Temperature	Thermometer
2	pH	pH metry
3	Electrical conductivity	Conductometry
4	Total dissolved solids	Evaporation method
5	Alkalinity as $CaCO_3$	Titrimetry
6	Total hardness	EDTA – Titrimetry
7	Calcium	EDTA – Titrimetry
8	Magnesium	EDTA – Titrimetry
9	Sodium	Flame photometry
10	Potassium	Flame photometry
11	Chloride	Argentometric
12	Nitrate	Spectrophotometry
13	Sulphate	Spectrophotometry
14	Phosphate	Spectrophotometry
15	Dissolved oxygen	Titrimetry
16	Fluoride	Fluoride meter

Table 2: Indian standard specification for drinking water ISI:10500 (Fakayode, 2005)

Sl.No.	Parameters	Desirable limit	Permissible limit
1	Temperature (° C)	-	-
2	pH	6.5 – 8.5	No relaxation
3	EC (μg/cm)	500	1000
4	TDS (mg/l)	500	2000
5	Total hardness (mg/l)	300	600
6	Total alkalinity	200	600
7	Calcium (mg/l)	75	200
8	Magnesium (mg/l)	30	100
9	DO (mg/l)	3	10
10	Chloride (mg/l)	250	1000
11	Sulphate (mg/l)	200	400
12	Nitrate (mg/l)	45	100
13	Fluoride (mg/l)	1	1.5

Table 3: Physico-chemical data for water samples of Shivamogga district

Sample	EC	pH	DO mg/l	Salinity mg/l	TDS	Total Alkalinity
Harige	242	6.9	3.6	410	270	114
Machenahalli Industrial Area	198	7.1	4.4	278	295	290
Nidige	45	7.2	2.6	20.5	130	300
City area	16	7.8	2.8	11.5	160.4	310

Table 4: Water quality data of different areas of Shivamogga district

Sample	Free CO_2	Chloride	Fluoride	Iron	BOD	Total hardness
Harige	12	235	0.8	0.36	0.8	110
Machenahalli Industrial Area	18	250	2.2	1.98	3.8	140
Nidige	22	21	0.3	0.95	1.5	120
City area	10	15	0.5	0.40	1.6	94

Note: All the parameters are expressed in mg/l except pH and Electrical conductivity (µmhos/cm)