



Analysis of Ground Water Quality Using Physico-Chemical Parameters in Nagarbhavi Village of Bangalore

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ABSTRACT

Ground water samples were collected from different sampling point in Nagarbhavi village of Bangalore and analysed for common water quality parameters like electrical conductivity, total alkalinity, chloride, sodium, potassium, magnesium, calcium and important water quality parameters like total dissolved solids, pH, dissolved oxygen, BOD, COD and total hardness. On comparing results against drinking water quality standards laid by Bureau of Indian Standards (BIS), it is found that almost all the physico-chemical parameters of the water were within the permissible limits and can be used for domestic, irrigation and pisciculture.

Keywords: Physico-chemical parameters, Ground water quality, Total alkalinity, Total hardness, TDS.

INTRODUCTION

Ground water is used for domestic, industrial, water supply and irrigation all over the world. In the last few decades there has been a tremendous increase in the demand for fresh water due to rapid growth of population, unplanned urbanisation, industrialization and too much use of fertilizers and pesticides in agriculture [1].

Ground water is considered as one of the purest forms of water available in nature and meets the overall demand of rural as well as urban population. With the growth of industry the ground water is made susceptible for contamination due to addition of waste materials. Waste materials from the factories percolate with rain water and reach aquifer resulting in erosion of ground water supply.

Quality of water is an important factor in development and use of ground water as resources [2]. The potable water should be free from pathogenic agents and chemical constituents, pleasant to taste and usable for domestic purposes [3]. The ground water is characterised by multiple quality problems [4]. Many hazardous pollutants viz., colored dyes, heavy metals, nitrates and fluoride pollute it. The water is a universal solvent, which contain many dissolved substances. The problem of ground water quality is more acute and can be seen obviously in highly polluted areas [5, 6]. Shortage of drinking water worldwide is becoming very acute nowadays about 25% of earth's water is fresh and potable for human use. The ground water represents 13% of this water. Ground water has been used for drinking for a long time due to its

purity and has made it very important source for potable water widely [7]. The public desires water that is low in hardness and total solids, non- corrosive and non- scale forming. To provide such water, chemists, biologists and engineers must combine their efforts and talents. Chemists, through their knowledge of colloidal, physical and organic chemistry are especially helpful in solving problems related to the removal of colour, turbidity, hardness, harmful metal ions and organic compounds and to the control of corrosion and scaling.

MATERIALS AND METHODS

Bangalore is located in the heart of south-Deccan plateau peninsular India to the south-East corner of Karnataka state between the latitudinal parallel of $12^{\circ} 39' N$ and $13^{\circ} 18' N$ longitudinal meridians of $77^{\circ} 22' E$ and $77^{\circ} 52' E$ at an altitude of 900m average mean sea level covering an area of about 2191 sq. km. For convenience it was divided into 5 phases as North, South, East, West and central phases. The Nagarbhavi village is located in the west phase of the city.

Sampling was made once during the study period between 11.00 AM to 17.00 PM on each sampling day. The samples for the routine analysis of parameters were collected in 500ml polyethylene bottles. The DO samples were collected in 250ml glass bottles. The samples for determining the BOD were collected in 250ml dark bottles. pH and conductivity (μ mhos/cm) were determined at the site. The methods used for determining Total hardness, Total alkalinity, BOD, COD, Total dissolved solids were adopted from APHA 1995[8]

RESULTS AND DISCUSSION

Table 2, presents the range of common parameters used for assessing water quality. EC is the capacity of water to carry ions, so it depends on the presence of ions and their concentration. EC varies in the range $814 \mu\text{mohs cm}^{-1}$ to $834 \mu\text{mohs cm}^{-1}$.

The presence of carbonate, bicarbonate and hydroxide is the main cause of alkalinity in natural water. The alkalinity value in the ground water varied from 133 to 159 mg L^{-1} . The concentration of chloride varied between 45 to 65 mg L^{-1} . which are well within the limit according to BIS.

The calcium and magnesium content of water sample fluctuated in the range of 74 to 99 mg l^{-1} and 46 to 81 mg L^{-1} respectively. The sodium concentration varied from 91 to 107.2 mg L^{-1} in the study area. The main sources of potassium in the groundwater include rain water, weathering of potash silicate minerals. The potassium concentration ranged from 1.3 to 3 mg L^{-1} in the groundwater samples.

Table 3, summarizes the range of important parameters used for assessing water quality. The pH of the groundwater in the study area varied from 8.00 to 8.24 . The pH values of sample under study indicate that groundwater is slightly alkaline.

The presences of dissolve oxygen (DO) enhances the quality of water and also acceptability. An ideal DO value of 5.0 mg L^{-1} is the standard for drinking water [9]. Dissolved oxygen (DO) of water under the area determined in the present investigation ranged between 6.7 to 7.5 mg L^{-1} .

Biochemical oxygen demand (BOD) is a chemical procedure for determining the amount of dissolved oxygen needed by aerobic biological organism in a body of water to breakdown organic material present in a given water sample at certain temperature over a specific time period. It is not a precise quantitative test, although it is widely as an indication of the organic quality of water [10]. According to BIS, The permissible limit of BOD in water is 4 mg L^{-1} . However, in all five stations samples showed the permissible limits. Chemical oxygen demand (COD) is a measure of pollution in aquatic system. High COD may cause oxygen depletion on account of decomposition by microbes [11] to a level detrimental to aquatic life. In the present study COD values are found to be 13.3 to 54.3 mg L^{-1} .

According to BIS, the maximum acceptable limit of TDS in groundwater for domestic purpose is 2000 mg L⁻¹. TDS found to be varied from 126 to 190 mg L⁻¹ which is well within the desirable limit. The hardness of water is primarily due to the presence of calcium and magnesium along with their carbonates, sulphates and chlorides in groundwater [12]. The data revealed that the values of hardness ranged between 125 to 158 mg L⁻¹

Table 1:- BIS standard of desirable and permissible limits of various parameters.

S. NO	PARAMETERS	DL (mg/l)	PL (mg/l)
1.	Alkali airy	200	600
2.	Chloride	250	100
3.	Calcium	25	200
4.	Magnesium	30	100
5.	T D S	500	2000
6.	D O	4.0	4.0
7.	B. O.D	---	3.0
8.	C. O.D	250	250
9.	pH	6.5	8.5
10.	T H	300	600

DL: Desirable limits, PL: Permissible limits, BIS: Bureau of Indian standard.

Table 2: - Common water quality parameters of drinking water.

Parameters	Station 1	Station 2	Station 3	Station 4	Station 5
Electrical Conductivity (μ mhos/cm)	828	834	785	778	814
Total alkalinity (mg/l)	155	143	154	133	159
Chloride (mg/l)	52	45	57	51	65
Na (mg/l)	92	94.1	91	91.2	107.2
K (mg/l)	1.4	1.3	1.5	1.3	3
CaH (mg/l)	99	95	90	74	96
MgH (mg/l)	46	50	52	56	81

Table 3: - Important water quality parameters of drinking water.

Parameters	Station 1	Station 2	Station 3	Station 4	Station 5
T D S (mg/l)	143	146	138	126	190
D O (mg/l)	6.7	6.8	6.9	7.1	7.5
B O D (mg/l)	1.5	1.5	4.9	1.3	1.3
C O D (mg/l)	13.3	13.3	54.3	13.3	13.3
pH	8.24	8.05	8.00	8.04	8.12
T H (mg/l)	142	142	138	125	158

APPLICATIONS

These studies are useful for knowing the quality of water quality parameters.

CONCLUSIONS

All the physico-chemical characteristic of ground water in Nagarbhavi area of Bangalore were within the desirable limits. The results obtained from the present investigation shall be useful in future management of ground water. The physico-chemical characteristics of ground water suggested that there was no harmful to pisciculture, irrigation and drinking water.

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