ASSESSMENT OF GROUNDWATER QUALITY IN PARSHIVANI REGION OF NAGPUR DISTRICT, MAHARASHTRA, INDIA

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Groundwater samples from open wells were collected from ten different villages from Parshivani Taluka of Nagpur District of Maharashtra. The physicochemical parameters such as temperature, pH, electrical conductivity (EC), total dissolve solid (TDS), total alkalinity, calcium and magnesium hardness, sodium, potassium, chloride, sulphate and nitrate were analyzed and the results were compared with water quality standards prescribed by ISI and WHO.

Key words: Physicochemical parameter, Ground water, Parshivani.

INTRODUCTION

Water is extremely essential for survival of all living organisms. Life cannot exist on this planet without water. Approx 97.2% of water on earth is salty and only 2.8% is present as fresh water from which about 20% constitutes ground-water [1]. The well water are widely used in every country in the world for a variety of industrial, marine, irrigation and leisure activities. Groundwater is generally considered to be much cleaner than surface water [2]. However, several factors such as discharge of industrial, agricultural and domestic wastes, land use practices, geological formation, rainfall patterns and infiltration rate affects the groundwater quality and once contamination of groundwater in aquifers occurs, it persists for hundreds of years because of very slow movement in them [3]. Water pollution are mainly due to contamination by foreign matter such as microorganism, chemicals, industrial or other wastes or sewage which deteriorate the quality of the water and render it unfit for its intended uses. Ingestion of polluted water can result various health hazards. Disposal of sewage water into fresh water aquifers is the main cause of groundwater pollution. Hence determination of groundwater quality is important to observe the suitability of water for particular use. Groundwater monitoring of is one of the important tool for evaluating groundwater quality. A good number of water analysis experiments are regularly conducted by different groups of chemists and biologists across the country [4, 5, 6, 7, 8, 9, 10].

In the absence of regular fresh water supply, people residing in the nearby villages located around Parshivani region are forced to take ground water (Dug well and Hand pump water) for their domestic and drinking consumption. Hence it was thought interesting to carry out an analysis of the physico-chemical parameters such as temperature, pH, electrical conductivity (EC), total dissolved solids, chloride, total alkalinity, calcium and magnesium hardness, sodium, potassium, sulphate, nitrate of groundwater.

MATERIAL AND METHOD

All the chemicals used were of AR grade. Double distilled water was used for the preparation of reagents and solutions. In the present study ground water (open well water) samples from ten different villages (Table-1) located in Parshivani Taluka of Nagpur District were collected in polyethylene containers of 1 L capacity for physicochemical analysis from the source such that, the sample collected serves as a representative sample [11].

The major water quality parameters considered for the examination in this study are temperature, pH, electrical conductivity (EC), total dissolve solid (TDS), total alkalinity, calcium and magnesium hardness, sodium, potassium, chloride, sulphate and nitrate [12]. Temperature, pH, T.D.S. values were measured by water analysis kit and manual methods. Calcium and magnesium hardness of water was estimated by complexometric titration method [12]. Chloride contents were determined volumetrically by silver nitrate titrimetric method using potassium chromate indicator [13]. Sodium and Potassium values were determined by Flame photometer. Sulphate and Nitrate contents were analyzed by UV-Visible spectrophotometer.

Table 1 : Description of water sampling sites

Water Sample Code	Water Source	Location (Villages)
S1	Open well	Kanhan
S2	Open well	Kandri
S3	Open well	Varada
S4	Open well	Dumrikhurd
S5	Open well	Dumarikala
S6	Open well	Satak
S7	Open well	Aamadi
S8	Open well	Nayakund
S9	Open well	Mahuli
S10	Open well	Kadafata

RESULTS AND DISCUSSION

The physico-chemical data of the ground water (well water) samples collected in October 2012 are presented in Table-2. The results of the samples vary with different collecting places because of the different nature of soil contamination [13]. All metabolic and physiological activities and life processes of aquatic organisms are generally influenced by water temperature. In the present study temperature ranged from 26.9-28.3°C.

The pH values of drinking water is an important index of acidity, alkalinity and resulting values of the acidic-basic interaction of a number of its mineral and organic components. pH below 6.5 starts corrosion in pipes, resulting in release of toxic metals. In the present study pH ranged from 7.5 to 8.1, which lies in the range prescribed by APHA [14].

According to WHO and Indian standards, TDS values should be less than 500 mg/L for drinking water. In the present study TDS ranged from 283 mg/L to 885 mg/L. In the present

study three samples S5, S8 and S9 exceed the range suggested by WHO and Indian Standards [15].

Table 2. Analysis results of the samples collected from different villages located in Parshivani Taluka of Nagpur District.

Water Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Colour	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Temperature °C	28.0	27.5	27.8	28.3	27.9	27.6	28.1	27.4	27.9	26.9
pH	7.5	7.8	7.8	8.1	7.9	8.0	7.8	7.9	7.8	8.1
EC (mmhos/cm)	0.975	1.094	1.008	0.726	1.648	0.964	0.747	1.475	1.149	0.596
TDS (ppm)	446	457	458	337	885	449	340	783	537	283
Total Alkalinity (ppm)	389	357	368	194	292	265	332	377	386	186
Ca-Hardness(ppm)	184	160	125	147	331	184	116	228	405	176
Mg-Hardness(ppm)	72	64	42	36	87	48	57	62	78	41
Sodium (ppm)	46	89	97	87	99	34	82	95	36	17
Potassium (ppm)	1.0	3.8	4.5	2.7	4.6	0.9	2.6	7.4	6.2	5.8
Chloride (ppm)	59	93	56	33	245	116	25	180	98	36
Sulphate(ppm)	14	18	12	16	24	15	18	18	14	10
Nitrate (ppm)	1.12	1.37	2.16	1.46	1.62	1.25	1.44	2.82	1.73	0.97

Electrical conductivity (EC), values were observed in the range of 0.596 to 1.648 mmhos/cm. EC values were found within ISI limit except sampling site S5 indicating the presence of high amount of dissolved inorganic substances in ionized form.

The chloride content in the samples is in between 25 to 245 mg/L. Natural water contains low chloride ions. The findings indicate that all water samples were within the desirable limits of chloride in drinking water, prescribed by Indian Standard Index [15].

Total Alkalinity is a total measure of substance in water that has "acid-neutralizing" capacity. The main sources of natural alkalinity are rocks which contain carbonate (CO_3^{2-}), bicarbonate (HCO_3^{1-}) and hydroxide (OH^{1-}) compounds; silicates (SiO_4^{3-}) and phosphates (PO_4^{2-}) may also contribute to alkalinity. Total alkalinity values for tested samples except S4 and S10 were found to be greater than the value prescribed by ISI [15]. In the present study total alkalinity ranged from 186-389 mg/L.

The limits of calcium and magnesium have been prescribed in the range 75-200 mg/l and 50-100 mg/L respectively [16].

In the present investigation, calcium concentration ranged from 116 mg/L to 405 mg/L and found above prescribed limit in samples S5, S8 and S9 according to ISI. Calcium is needed for the body in small quantities, though water provides only a part of total requirements [16].

Magnesium content in the investigated water samples was varied from 36 mg/L to 87 mg/L, which lies in the range prescribed by ISI.

The concentration of sulphate in water sample is observed to be within the limit prescribed [17] for sulphate content and it varies from 10 mg/L to 24 mg/L. The high concentrations of sulphate may induce diarrhea [17].

Nitrate nitrogen is one of the major constituents of organism along with carbon and hydrogen as amino acids, protein and organic compounds, in the ground water [18]. In the present study nitrate nitrogen levels show within the prescribed values [18].

Sodium and potassium contents in the investigated water samples were varied from 17 mg/L to 99 mg/L and 0.9 mg/L to 7.4 mg/L respectively.

CONCLUSION

The analysis of the water quality parameters of groundwater from ten sources shows that few parameters are not under permissible limit. In conclusions from the results of the present study it may be said that the ground water of Parshivani region is though fit for domestic purpose but drinking water need treatments to minimize the contamination.

ACKNOWLEDGEMENTS

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