



Physico-chemical analysis of groundwater used for drinking and domestic purpose in Kasganj district of Uttar Pradesh (India)

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Abstract

Water samples of underground water were collected from five different areas such as (S-1), Avas Vikas colony (S-2), State Bank Colony (S-3) Durga colony (S-4), Shivpuri Colony (S-5) Nai basti Nagla Bale areas of Kasganj district of U.P. (India) in the month of November 2022. The Physico-chemical parameters including Colour, Odour, Temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), total hardness (TH). Calcium (Ca^{2+}), magnesium (Mg^{2+}), chloride (Cl) and sulphate (SO_4^{2-}) were analyzed and the results were compared with standards (maximum permissible limits) for drinking water recommended by World Health Organization (WHO) and ISI 10500-91. It was found that all the underground water samples are suitable for drinking and other domestic purposes.

Keywords: Chemical oxygen demand (COD), dissolved oxygen (DO), total dissolved solids (TDS), sulphate, physico-chemical analysis, ground water, Kasganj district

Introduction

Water is the essential element for life on the earth. Without water there would be no life. Over one billion people worldwide have no access to safe drinking water [1]. The quality of water is vital concern for mankind since it is directly linked with human welfare. The quality of water is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. The availability of water through surface and groundwater resources has become critical day by day. Only 0.003% of the earth's total volume of water is easily available to us as soil moisture, water vapour, ground water and water in the lakes, streams, wetlands, and rivers for drinking, agriculture, domestic power generation, industrial consumption, transportation and waste disposal [2, 4]. The problems of groundwater quality are much more acute in the areas which are densely populated and thickly industrialized. The rapid growth of urban areas has further affected groundwater quality due to over exploitation of resources and improper waste disposal practices. The consequence of urbanization and industrialization leads to spoil the water. For agricultural purposes ground water is explored in rural areas especially in those areas where other sources of water like dam and river or the canal is not available. During last decade, this is observed that the ground water get polluted drastically because of increased human activities [5-7]. Consequently number of cases of water borne diseases has been seen which a cause of health hazards [8-10]. So, basic monitoring on water quality has been necessitated to observe the demand and pollution level of ground water. A good number of water analysis experiments are regularly conducted by different groups of chemists and biologists across the country [11-13]. The present work is an attempt to examine the possible impact of the groundwater quality of some water sample in different locations of district Bareilly.

Thus, in this research work an attempt has been made to assess the physico-chemical parameters of groundwater like colour, odour, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), total hardness (TH), calcium (Ca), magnesium (Mg), chloride (Cl) and sulphate (SO) of bore well were determined. The analyzed data were compared with recommended WHO standard values [14].

Materials and Methods

People at different locations of Kasganj district of Uttar Pradesh (India) are using tube well water for their daily need. The literature survey reveals that no water quality management studies were made in this region so far. Hence the present study was planned and under taken. Water samples from five sampling points Such as: Avas vikas Colony (S-1), State Bank Colony (S-2), Durga colony (S-3), Shivpuri colony (S-4) Nai Basti Nagla Bale (S-5) of Kasganj district were collected in the month of November 2022.

Preparation of water samples

All the samples were collected in the month of November 2022 for physico-chemical analysis, different methods of collection and handling were adopted based the standard procedures [15]. The samples were collected in plastic canes of three liter capacity without any air bubbles. The temperature of the samples was measured in the field itself at the time of sample collection.

Results and Discussion

The physical and chemical parameters exhibited considerable variations from sample to sample. All the measurements were carried out in the vicinity of 35°C. The observation are summarized in Table –.1 and Table –.2. It is clear from above table that all the water samples have no objectionable colour and odour.

Table 1: Colour variations from samples of ground water of Kasganj District of U.P. (India)

Awass Vikas Colony		Colour	Odour
1.	State Bank Colony	Colour less	Odour less
2.	Durga Colony	Colour less	Odour less
3.	Shivpuri Colony	Colour less	Odour less
4.	Nai Basti Nagla Bali	Colour less	Odour less

Table 2: Physico chemical parameters of ground water of Kasganj District U.P. (India)

S. No.	Parameters	S-1	S-2	S-3	S-4	S-5	S-6
1.	Temperature °C	30	29	29	31	30	29
2.	pH	7.5	7.8	8.1	7.8	8.2	7.6
3.	TDS mg/L	175	230	285	270	245	45
4.	E.C.mho/cm	690	914	1118	1056	954	175
5.	Ca hardness mg/L	115	122	210	165	155	32
6.	Mg hardness mg/L	50	54	120	96	85	15
7.	T. hardness mg/L	165	176	330	261	240	47
8.	Chloride mg/L	123	144	223	220	175	17.5
9.	Sulphate mg/L	39	58	90	87	74	21.4
10.	D.O. mg/L	7.3	5.4	6.8	5.9	6.2	7.2
11.	C.O.D. mg/L	9.6	11	10.2	12.1	13.4	-

pH: pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the waters are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 7.5 to 8.2 and only minor fluctuation in pH was recorded and was found within the limit (7 to 8.5) prescribed by WHO. The pH levels were within the limits set for domestic use as prescribed by APHA [16].

Total dissolved solid (TDS): Total dissolved solid comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulphate) and some small amounts of organic matter that are dissolve in water. TDS indicate the salinity behavior of groundwater. According to United States Environmental Protection Agency (EPA), WHO and Bureau of Indian Standard (IS:10500) guidelines the limiting value of TDS for drinking water is 500 mg/l. In the present investigation this limit is not crossed by any of the samples under study. The water of the samples have registered good values of TDS (175-285 mg/L). These values are acceptable for domestic use and agricultural purposes.

Electrical Conductivity (EC): Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts¹⁷. An overwhelming value of TDS has also increased the electrical conductivity values of the different water samples ranging from 175 mho/cm -1118 mho/cm. All the analyze sample showed EC value within the range prescribed by WHO.(1400 mho/ cm)

Total hardness (TH): Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water [18]. Hardness of water mainly depends upon the total amount of calcium and magnesium salts. In the present investigation, it has been observed that the calcium concentration is at least double than that of magnesium. Each of the sample showed a high value of calcium hardness range from 32 mg/L to 210 mg/L, magnesium hardness range from 15 mg/ L to 120 mg/L and

in turn the total hardness range from 47 mg/L to 330 mg/L as shown in the table. A significant presence of anions like chloride and sulfate is also observed in the water samples under investigation. It has been observed that greater amount of sulfate in drinking water causes diarrhea. The chloride and sulfate amounts in the samples range from 17.5 mg/L-220 mg/L and 21.4 mg/L -90 mg/L respectively. Here it is observed that the sulfate concentration in the samples fall well within the prescribed limit but the chloride content is much higher than the permitted values of WHO and ISI.

Dissolved oxygen (DO): Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water. Dissolved oxygen present in drinking water adds taste and it is highly fluctuating factor in water. In this study dissolved oxygen content varied in a limited range of 5.4 to 7.3.

Chemical Oxygen Demand (COD): Chemical oxygen demand (COD) is commonly used to indirectly measure the amount of organic compounds in water. Most applications of COD determine the amount of organic pollutants found in surface water (e.g. lakes and rivers), making COD a useful measure quality. It is expressed in milligrams per liter (mg/L), which indicates the mass of oxygen consumed per liter of solution. The maximum allowed value of chemical oxygen demand (COD) is 10 mg/L in drinking water. The present samples have registered a range of 9.6 to 13.4 mg/L. These values are little higher than that expected for a good quality drinking water.

Conclusion

The present investigations has led us to conclude that the quality of water samples collected from ground water of Kasganj District of U.P. (India) were subjected to study it showed physico-chemical parameters within the water quality standards and the quality of water is good and it is fit for domestic application as well as commercial purposes. For domestic purposes, it is recommended that water can be definitely used after practicing suitable disinfections system. The mineral water is found to be safest for drinking purpose

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