

Physico-Chemical Analysis of Ground water of Basti Sadar Block of District Basti, (U.P.), India

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Abstract

The present investigation was carried out during Jun-July 2013, to analysed the water quality for the ground water of Basti Sadar block of district Basti, U.P. India. Total ten numbers of ground water samples were collected from different locations of the block and analysed for the various physico-chemical parameters such as pH, turbidity, fluoride, Total Hardness, Chloride, Nitrate, Iron and Free Chlorine. The results were also compared with WHO, BIS and ICMR standards. The analysis reveals that most of the parameter are found under permissible limit but some are exceeds the maximum permissible limit of WHO and other standards.

Key words: Ground water, Basti, Total Hardness, BIS, ICMR.

Introduction

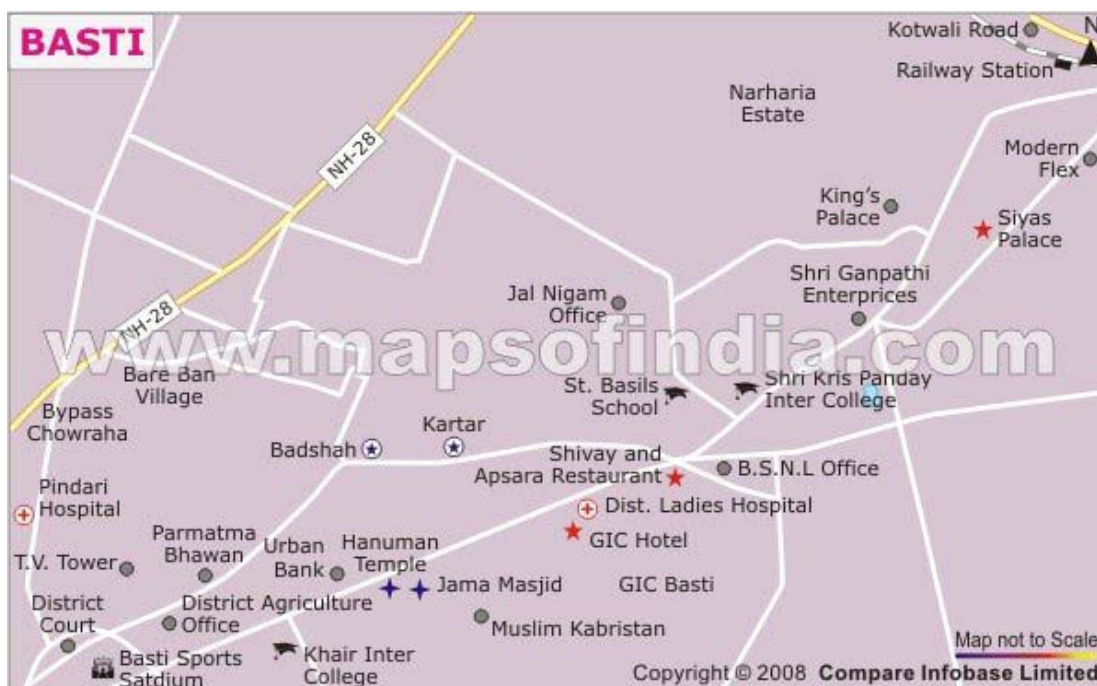
Water is indispensable and one of the precious natural resources of this planet. Ground water is an important source of water supply throughout the world¹. The term ground water is generally used for the subsurface water that occurs beneath the water table in soil and geologic formation that are fully saturated². The safe potable water is absolutely essential for healthy living. Ground water is ultimate and most suitable fresh water resource for human consumption in both urban as well as rural areas. It supports drinking water supply; livestock needs irrigation, industrial and many commercial activities³. The importance of ground water for existence of human society cannot be over-emphasized⁴. There are several states in India where more than 90% population are dependent on ground water for drinking and other purpose⁵.

The Geology of a particular area has a great influence on quality of water and its environment. Many a time ground water carries higher mineral contents than surface water, because there is slow circulation and longer period of contact with sediment materials in case of ground water⁶. Changes of ground water quality with the passage of time have hydrologic significances. The quality also varies due to a change in chemical composition of the underlying sediments and aquifer⁷⁻⁸. The ground water chemistry is controlled by the composition of its recharge components as well as by geological and hydrologic variations within the aquifer.

Water quality plays an important role in the overall water balance of the environment. Polluted ground water is the cause for the speed of epidemics and chronic diseases in human beings⁶. A large number of people has to die because of water born diseases every year in our country. U.P. is of no exception. In U.P. the population is dependent many on ground water source to fulfill their daily needs related to water. Mostly, the people are dependent on the own sources for getting water. There is lack of detail information regarding the overall quality of water sources of this block. Thus having water samples tested regularly is the only way to be sure that the ground water is not contaminated. So present study has been carry out to qualitative analysis of some physico-chemical parameters of ground water of Basti sadar block of district Basti, U.P. , India.

Methods and Materials :

Study Site: Basti sadar block is situated in the center of Basti District of U.P. India. Which is 65 km west to the Gorakhpur district and 90 km east to the Gonda district. Its located between 26° 23' N latitude and 83°E longitude. The NH-28 croos through the Basti Sadar block. The average annual rain fall is varies from 1050 mm to 1200mm.



Sample Collection :

The sampling collection consists of urban as well as rural areas, which are around 7 km from city center. The ground water samples were collected from 10 various locations by hand pump within study area during June-July months of 2013.

The samples were collected in plastic bottles which are cleaned with acid water followed by rinsing twice with distilled water. The chemical analysis of water sample was done by using Hi-media water testing kit. The sampling places are listed in table-1

Table 1. Sampling places in the Basti Sadar Block.

Sr. No.	Sampling places	Site
1	Bhitya Chauraha	S1
2	Walterganj Market	S2
3	Hardiya Chauraha	S3
4	Badeban	S4
5	Company Bag	S5
6	Gandhi Nagar	S6
7	Basti Bus Station	S7
8	Near District Hospital	S8
9	Near Basti Railway Station	S9
10	Manauri Chauraha	S10

Results and Discussion

Results obtained during the analysis were shown in the Table-2 and compared with values of WHO⁹, ICMR¹⁰, and BIS¹¹, drinking water standards which is given in table -3. The data revealed a considerable variation in the water samples with respect to their chemical composition.

Table 2 : Various water quality parameters of Basti Sadar Block.

Sampling Site →	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Parameters ↓										
pH	7.4	7.2	7.1	7.0	7.1	7.1	7.4	7.3	7.2	7.1
Turbidity (NTU)	5	6	5	9	5	5	10	5	5	5
Chloride (mg/lit).	60	130	90	50	60	150	160	140	80	70
Total Hard (mg/lit.)	350	775	525	325	350	625	625	625	475	425
Nitrate (mg/lit.)	8	90	80	35	10	80	70	40	90	60
Fluoride (mg/lit.)	0.60	0.50	0.4	0.5	0.5	0.7	0.5	0.9	0.8	0.6
Iron (mg/lit.)	0.5	0.3	0.2	1.0	0.3	0.2	0.4	1.0	0.3	0.3
Free Chlorine	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Table 3 : Comparison of water Parameters with drinking water quality Standards.

S.No.	Parameters	WHO	ICMR	BIS	Range		Mean	SD
					Min.	Max.		
1	pH	6.5-9.2	6.5-8.5	6.5-8.5	7.0	7.4	7.2	0.14
2	Turbidity (NTU)	10	10	10	5	10	6.0	1.89
3	Chloride (mg/lit.)	250	250	250	50	160	99	41.75
4	Total Hardness (mg/lit.)	600	600	600	325	775	510	150.5
5	Nitrate (mg/lit.)	50	50	45	8	90	56.30	31.26
6	Fluoride (mg/lit.)	1.5	1.0	1.5	0.4	0.9	0.6	0.16
7	Iron (mg/lit.)	1.0	1.0	1.0	0.2	1.0	0.45	0.30
8	Free Chlorine	-	-	-	-	-	-	-

The pH of water is an important indication of its quality and provide significant information in many types of geochemical equilibrium solubility calculation¹². The pH of ground water ranges from 7.0-7.4. It indicates that they are in range of ground water quality parameter permissible limits i.e.,6.5-9.2 and slightly alkaline in nature¹³⁻¹⁵. Turbidity of study area ranges from 5-10 NTU. It indicates that ground water of all samples are in the permissible limit of all drinking water quality standards¹⁶.

Chloride occurs in all natural water are in widely varying concentration. It in excess (>250mg/lit.) impart a softy taste to water¹⁷. Chloride value range from 50-160 mg/lit. The chloride content was normal than that of the permissible limit¹⁷.

According to Durfor and Backer classification of total hardness¹⁸, water was very hard at all the locations and ranges from 325-775 mg/lit. Nearly 50% water samples have higher value of total hardness to the permissible limit of different standard^{15,19-21}. Nitrates represent the final product of biochemical oxidation of ammonia. Monitoring of nitrates in drinking water supply is very important because of health effects on human and animals²². Nitrate ranges from 8-90 mg/lit. The samples number 1,4,5 and 8 are under permissible limits but samples number 2,3,6,7,9 and 10 are exceeds the maximum permissible limit of 50mg/lit. of different standard.

Fluoride at a lower concentration at an average of 1mg/lit. is regarded as an important constituents of drinking water²³. The concentration of fluoride in drinking water is critical considering health problems related to teeth and bones. Continuous consumption of water having high fluoride content can cause diseases like fluorosis, dental and bone diseases²⁴. The low concentration of fluoride in drinking water results in dental carries in children particularly when the fluoride concentration is less than 0.5 mg/lit.²⁵. The concentration of fluoride ion in study area are within tolerance limit except sample number 3 is slightly lower than the specific value^{6,26}.

In drinking water iron may be present as Fe^{+2} , Fe^{+3} and $\text{Fe}(\text{OH})_3$ in suspend or filterable forms²⁷. However excessive concentration may cause problems like rapid increase in respiration, hypertension and drowsiness²⁸. The iron concentration in the study area ranges from 0.2-1.0 mg/lit. All samples are well within the permissible limit^{4,15,16,26,27}. The free chlorine was found to be absent in all samples^{15,28}.

Conclusion

In the present study the concentration of many parameters as pH, Turbidity, Chloride, Fluoride and Iron in all samples were found within the permissible limits as prescribed by different standards. The hardness of samples number 1, 3, 4, 5, 9 and 10 were found within the permissible limits where as sample number 2, 6, 7 and 8 are exceeds the maximum permissible limits. The concentration of nitrate of some samples were found within the permissible limits where as some samples are exceeds the maximum permissible limits. The observed standard deviation for the parameters shows that the deviation in the total hardness (150.55), chloride (41.75) and nitrate (31.26) are of moderately high range. From this it is concluded that various parameter concentration are varying highly in different location of Basti sadar block of district Basti U.P. India. The maximum parameters were not at the level of pollution. So the ground water of this study area satisfy the requirement for the use in various purposes.

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