

Assessment of Groundwater Quality in Saltua Gopalpur Block of Basti District, (U.P.) India

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ABSTRACT

The present study was carried out to assess the ground water quality of various location of Saltua Gopalpur block of Basti district during June-July 2013. Total 10 water samples were collected from hand pumps at different locations in and around Saltua Gopalpur block. The water samples were analyzed for their physico-chemical characteristics, viz .pH, turbidity, chloride, total hardness, fluoride, nitrate, Iron and free chlorine. On comparing the results against water quality standards and standard values recommended by World Health Organization (WHO), it is found that most of the water samples are very hard and unsuitable for drinking purposes.

Key words: Ground water quality, Drinking water standards, Saltua Gopalpur, Total hardness.

INTRODUCTION

Water is a one of the most important renewable natural resources. Approximately 71% of the earth's surface is covered with water. Fresh water is found as underground water in large reservoirs surrounded by rock called aquifers. This ground water has long been considered as one of the purest forms of water available in nature to meet the overall demand of rural and semi urban people¹. In India most of the population is dependent on ground water as it is the only source of drinking water supply². The quality of ground water is the resultant of all the processes and reaction that act on the water from the moment it condensed in the atmosphere to the time it is discharged by a well as spring and varies from place to place and with the depth of the water table³.

The groundwater is believed to comparatively cleaner and free from pollution than surface water². But during last decade, it is observed

that ground water gets polluted drastically because of increased human activities⁴⁻⁷. Consequently number of cases of water born diseases has been seen which are the causes of health hazards⁸⁻¹¹. Therefore monitoring the quality of water is one of the essential issues of drinking water management¹².

Considering the above aspects an attempt has been made under the present study to assess the physico-chemical properties of ground water in Saltua Gopalpur block of Basti district.

MATERIAL AND METHODS

Study Site

Saltua Gopalpur block is situated in the north part of the district Basti. It is 15 km. away from the district head quarter. It has a geographical area of 216.90 km², it is bounded by 26.81 °N latitude and 82.76 °E longitude. The normal annual rain fall varies from 1050 mm to 1200 mm.

Sample Collection

A total 10 samples from different places which were minimum 2-3 km between one and another location was maintained in order to carry out a broad study on the quality of water in this area. The sample collection area has been assigned as sample points.

Table 1. Sampling places in the Saltaua Gopalpur Block.

S.No.	Sampling places	Site
1	Aama	S1
2	Atara	S2
3	Baheriya	S3
4	Belhara	S4
5	Rehar Jungle	S5
6	Narayanpur	S6
7	Bhugania	S7
8	Saltaua Bazar	S8
9	Kanthui	S9
10	Saltaua Village	S10

The sample was collected in plastic bottles which were cleaned with acid water, followed by rinsing twice with distilled water. The analysis of water was done by using Himedia water testing kit.

RESULT AND DISCUSSION

The various physico-chemical parameters examined showed considerable variations in different samples. The observations are depicted in table-2. The findings and their comparison with WHO¹³ and BIS¹⁴ health based drinking guidelines are presented in table-3. The data revealed a considerable variation in the water samples with respect to their chemical composition.

pH is affected not only by the reaction of carbon dioxide but also by organic and inorganic solute present in water. Any alteration in water pH is accompanied by the change in other physico-chemical parameters¹⁵. pH varies from 7.0 to 7.5. This shows that all samples are existed within the minimum and maximum tolerable limit of WHO and

Table 2 : Physico-Chemical quality of ground water of Saltaua Gopalpur Block.

Sampling Site→ Parameters ↓	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
pH	7.1	7.0	7.1	7.1	7.5	7.3	7.2	7.0	7.2	7.1
Turbidity (NTU)	5	5	6	5	5	5	5	6	5	5
Chloride (mg/lit.)	50	20	20	70	10	60	220	20	20	10
Total Hard (mg/lit.)	325	200	275	375	250	550	750	350	350	375
Fluoride (mg/lit.)	1.0	0.5	0.4	0.8	1.0	0.3	0.5	0.6	0.8	0.5
Nitrate (mg/lit.)	90	40	45	10	10	45	95	10	30	10
Iron (mg/lit.)	1.0	0.3	0.5	0.8	0.5	0.9	1.0	0.7	0.8	0.6
Free Chlorine	Nil									

Table 3 : Comparison of water with drinking water quality standards.

S. No	Parameters	WHO	BIS	Range		Mean	SD
				Min.	Max.		
1	pH	6.5-8.5	6.5-8.5	7.0	7.5	7.16	0.15
2	Turbidity (NTU)	5	5	5	6	5.2	0.42
3	Chloride (mg/lit.)	250	250	10	220	50	63.42
4	Total Hardness (mg/lit.)	300	300	200	750	375.1	62.02
5	Nitrate (mg/lit.)	50	45	10	95	38.5	32.06
6	Fluoride (mg/lit.)	1.5	1.5	0.3	1.0	0.64	0.25
7	Iron (mg/lit.)	0.3	0.3	0.3	1.0	0.71	0.23
8	Free Chlorine	-	-	Nil	Nil	-	-

BIS. The water samples were found to be slightly basic in nature¹⁶⁻¹⁸.

The turbidity varies from 5-6 NTU. This shows that most of the samples are existed within permissible limit of WHO & BIS.

Chloride varies from 10-220 mg/lit. All the water samples are under the permissible limits as of WHO¹⁹⁻²⁰. Chloride is not harmful to human at low concentration but could alter the taste of water at concentration above 250mg/lit²¹.

Hardness is very important in decreasing the toxic effect of poisonous element²². Hardness is measured in terms of total hardness and calcium hardness. Total hardness varies form 200-750 mg/lit mostly exceeds the maximum permissible limits of WHO²²⁻²⁵. Hardness although has no health effects it can make water unsuitable for domestic and industrial use¹.

Nitrate varies from 10-95 mg/lit. Although only two samples S1 and S7 exceeds the permissible limit and shows high concentration²⁰. Nitrate indicates the pollution in ground water due to agricultural activities, sewage percolation beneath the surface^{22,26,27}. Presence of nitrate in water indicates the final stage of mineralization²⁸.

The major natural resource of fluoride is amphiboles, apatite, fluorite and mica. It's concentration in natural waters generally should not exceed 10mg/lit¹. The factor responsible for ground water contamination with fluoride are geological factors such as weathering of minerals, rock dissolution and decomposition. Containing fluoride over a long period of time resulting in the leaching it into ground water⁴. An anthropogenic factor such as industrial process liberates higher concentration of fluoride into atmosphere.

The concentration of fluoride in the studied water samples varies from 0.3 to 1.0mg/lit²⁰. High fluoride concentration causes dental fluorosis and

more skeletal fluorosis²⁹ whereas the low concentration or absence of fluoride in drinking water results in dental caries in children particularly when the fluoride concentration is less than 0.5 mg/lit³⁰.

The values of iron in study area varies from 0.3 to 1.0 mg/lit. Which are higher than the tolerable value except sample S6. This may be due to soil origin and age old iron pipes used in the area^{16,31}. The storage of iron causes a diseases called "anaemia" and prolonged consumption of drinking water with high concentration of iron may be lead to liver diseases called as haemosiderosis.

The free chlorine was found to be absent in all the samples.

CONCLUSION

The analysis of the physico-chemical parameters of ground water from ten different locations in Saltaua Gopalpur block shows that the pH, turbidity, chloride and fluoride were within permissible limit. Highly exceeded value of total hardness, nitrate and iron were reported at some locations of study area. The observed standard deviation for the parameters shows that the deviation in the total hardness (162.02), chloride (63.42) and nitrate (32.06) are of moderately high range. From this it is concluded that various parameter concentration are varying highly in different location of Saltaua Gopalpur block.

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