

GROUNDWATER QUALITY ASSESSMENT FOR DRINKING PURPOSE IN BAUND BLOCK, CHARKHI DADRI DISTRICT, HARYANA

Anup Kumar^{1*}, Himanshu², Satish Kumar² and V.S.Arya³

^{1,3}Haryana Space Applications Centre (HARSAC), Hisar

²Department of Geology, Kurukshetra University, Kurukshetra

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ABSTRACT

Water is important for survival of life on the planet Earth. In the present developmental activities water is excessively used in agriculture, industries, drinking and daily house hold activities. These has resulted in declining of groundwater depth and deterioration of groundwater quality. In the present study groundwater quality for drinking purpose has been assessed in Baund block of Charkhi Dadri district of Haryana. In the present study twelve groundwater samples were collected during field visit in the study area in double capped 250 ml plastic bottles and sample locations were taken with the help of mobile GPS. Groundwater samples were analyzed using Field Water Testing Kit prepared by Tamil Nadu Water Supply and Drainage (TWAD) Board, Chennai for twelve chemical parameters-pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, ammonia, nitrite, nitrate, phosphate, residual chlorine. Results of chemical analysis were entered in excel software and prepared bar graphs. Result of chemical analysis of groundwater samples were compared with BIS (IS 10500:2012) drinking water standards for drinking purpose. The study shows that pH ranges 6.5 to 7.5, alkalinity 150 mg/l to 550 mg/l, hardness 150 mg/l to 800 mg/l, chloride 50 mg/l to 1200 mg/l, TDS 600 mg/l to 2964 mg/l, iron nil to 3 mg/l, ammonia nil to 5 mg/l, nitrite 0.2 mg/l to 1 mg/l, nitrate 45 mg/l to 100 mg/l, phosphate nil in all the twelve groundwater samples and residual chlorine nil to 0.2 mg/l. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

Keywords: Groundwater, quality, drinking, Baund, Charkhi Dadri, Haryana.

INTRODUCTION

Water is important for living beings for survival. In the present context of increasing population, industrial setups and agriculture practices demand of water is increasing many folds. Need of the hour is to make a balance between the availability and demand of water for each user sectors based on priority. The utmost priority of water is for drinking purpose and households needs after agriculture and industrial requirement. Good quality water plays vital role for drinking and other household activities. Singh and Kumar (2014), Annapoorna and Janardhana (2015), Punia et al. (2015), Choudhary et al. (2016), Nelly and Mutua (2016), Kaur et al. (2017), Khan and Jhariya (2017),

Lalitha et al. (2017), Madhav et al.(2018), Mohamad (2019), Molekoa et al. (2019) studied the groundwater quality for drinking purpose in different area.

STUDY AREA

Baund block is falling in Charkhi Dadri district of Haryana (Fig.1). The geo-coordinates of the study area are latitudes 28.63° N to 28.82° N and longitudes 76.23° E to 76.41° E and covers an area of 234.40 sq. km. The study area falls in semi-arid type of climate. Geologically, the area has alluvium and blown sand of Quaternary age and geomorphologically alluvial plain and aeolian plain.

*Corresponding author: anup0106@yahoo.com

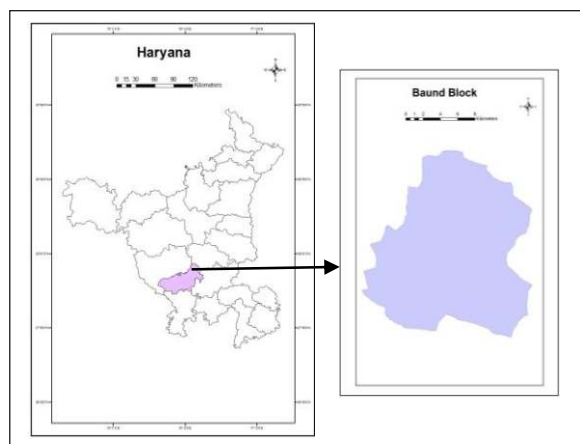


Fig.1: Location map of the study area.

OBJECTIVE

The main objective was to assessment of groundwater quality for drinking purpose in the study area.

MATERIALS AND METHODOLOGY

In the study area twelve groundwater samples were collected during the field visit and geo-coordinates of sample locations were taken with the help of mobile GPS. The groundwater samples were collected in double capped 250 ml plastic bottles from hand pump (HP), tube well (TW), dug well (DW) and labeled sample number and name of the location. Groundwater samples were analyzed using Field Water Testing Kit prepared by Tamil Nadu Water Supply and Drainage (TWAD) Board, Chennai for twelve chemical parameters-pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, ammonia, nitrite, nitrate, phosphate, residual chlorine (Table 1). Results of chemical analysis were entered in excel software and prepared bar graphs. Result of chemical analysis of groundwater samples were compared with BIS (IS 10500:2012) drinking water standards (Table 2) for drinking purpose of groundwater in the study area.

Table 1: Results of groundwater samples analysis in the study area.

S. No.	Location	Latitude	Longi-tude	Source	pH	Alkalinity (mg/l)	Hardness (mg/l)	Chloride	TDS	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)
1.	Sauf-Kasni	28.67	76.24	HP	7	200	250	50	600	0.5	0	0	0.5	75	0	0
2.	Misri	28.66	76.28	HP	7.5	460	800	1200	2952	1	1	1	0.5	75	0	0
3.	Sanwar	28.70	76.29	HP	7	150	450	250	1020	3	0	0.5	0.5	100	0	0
4.	Ranilla	28.70	76.35	HP	7.5	260	800	300	1632	5	0	1	1	75	0	0
5.	Bhageswari	28.67	76.35	TW1	7.5	430	320	250	1200	5	0	0.5	0.5	75	0	0
6.	Achina	28.65	76.36	DW	7	230	350	50	756	1.5	3	0.5	0.5	45	0	0
7.	Sanjarwas	28.72	76.31	HP	7	300	200	330	996	5	0	0.5	0.5	75	0	0
8.	Sankror	28.75	76.27	HP	7	330	150	70	660	5	0	0.5	0.2	45	0	0
9.	Baund	28.78	76.33	HP	6.5	180	400	100	816	1.5	0	0.5	0.5	100	0	0
10.	Baund Khurd	28.77	76.33	HP	7	550	800	1120	2964	0	0	5	0.5	45	0	0.2
11.	Unn	28.76	76.37	HP	7.5	300	400	120	984	5	0	1	0.5	75	0	0.2
12.	Malkos	28.78	76.31	DW	7.5	400	400	190	1188	5	0	0	0.5	75	0	0.2

Table 2: Drinking water standards (IS 10500:2012).

S. No.	Parameter	Potable		Non-Potable
		Desirable	Permissible	
1	pH	6.5 to 8.5	-	<6.5 and >8.5
2	Alkalinity (mg/l)	<200	200-600	>600
3	Total Hardness (mg/l)	<200	200-600	>600
4	Chloride (mg/l)	<250	250-1000	>1000
5	Total Dissolved Solids (TDS) (mg/l)	<500	500-2000	>2000
6	Fluoride (mg/l)	<1.0	1.0-1.5	>1.5
7	Iron (mg/l)	<0.3	-	>0.3

8	Ammonia (mg/l)	<0.5	-	>0.5
9	Nitrite (mg/l)	<1.0	-	>1.0
10	Nitrate (mg/l)	<45	-	>45
11	Phosphate (mg/l)	<1.0	-	>1.0
12	Residual Chlorine (mg/l)	<0.2	0.2-1.0	>1.0

RESULTS AND DISCUSSION

i. pH

In the study area pH ranges 6.5 to 7.5 (Table 1, Fig.2). As per BIS (IS 10500:2012) drinking water standards pH is desirable 6.5-8.5 and non-potable <6.5 and >8.5 (Table 2). pH is desirable in all the twelve groundwater samples (Saunf-Kasni, Misri, Sanwar, Ranilla, Bhageswari, Achina, Sanjarwas, Sankror, Baund, Baund Khurd, Unn, Malkos).

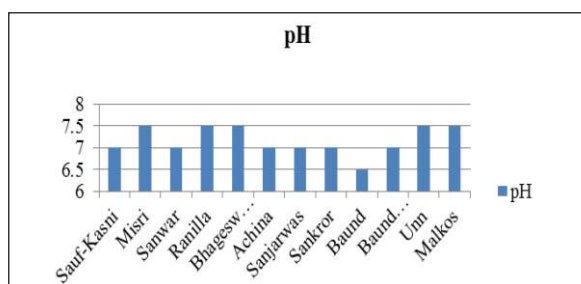


Fig. 2: pH in groundwater samples.

ii. Alkalinity

Alkalinity ranges 150 mg/l to 550 mg/l (Table 1, Fig.3) in the study area. As per BIS (IS 10500:2012) drinking water standards alkalinity is desirable <200mg/l, permissible 200 mg/l-600 mg/l and non-potable >600 mg/l (Table 2). Alkalinity is desirable in two groundwater samples (Sanwar, Baund) and permissible in ten groundwater samples (Saunf-Kasni, Misri, Ranilla, Bhageswari, Achina, Sanjarwas, Sankror, Baund Khurd, Unn, Malkos).

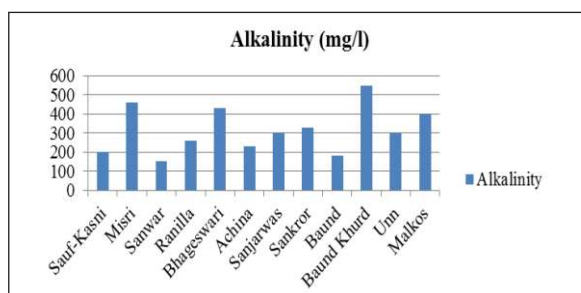


Fig. 3: Alkalinity in groundwater samples.

iii. Hardness

Hardness ranges 150 mg/l to 800 mg/l (Table 1, Fig.4) in the study area. As per BIS (IS 10500:2012) drinking water standards hardness is desirable <200 mg/l, permissible 200 mg/l-600 mg/l and non-potable >600 mg/l (Table 2). Hardness is desirable in one groundwater sample (Sankror), permissible in nine groundwater samples (Saunf-Kasni, Sanwar, Bhageswari, Achina, Sanjarwas, Baund, Unn, Malkos) and non-potable in three groundwater samples (Misri, Ranilla, Baund Khurd).

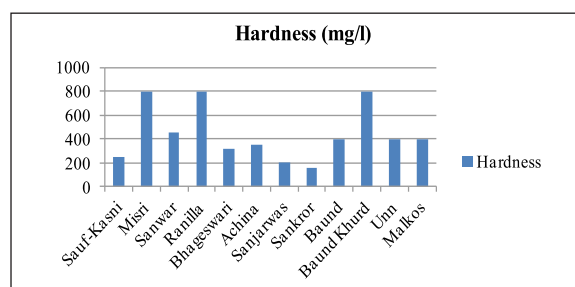


Fig. 4: Hardness in groundwater samples.

iv. Chloride

In the study area chloride ranges 50 mg/l to 1200 mg/l (Table 1, Fig.5). As per BIS (IS 10500:2012) drinking water standards chloride is desirable <250 mg/l, permissible 250 mg/l-1000mg/l and non-potable >1000mg/l (Table 2). Chloride is desirable in six groundwater samples (Saunf-Kasni, Achina, Sankror, Baund, Unn, Malkos), permissible in four groundwater samples (Sanwar, Ranilla, Bhageswari, Sanjarwas) and non-potable in two groundwater samples (Misri, Baund Khurd).

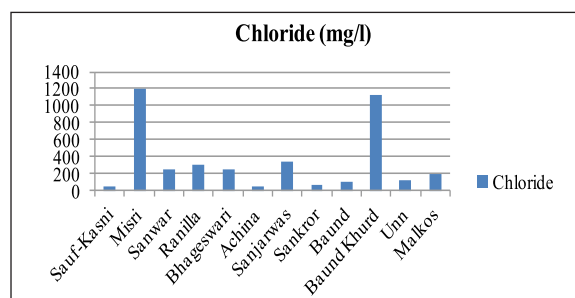
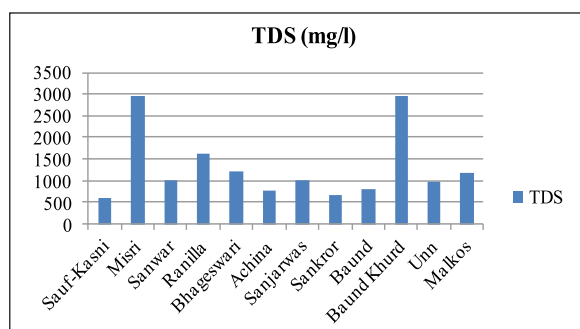


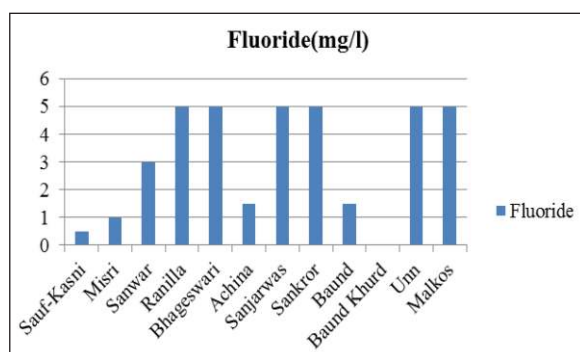
Fig. 5: Chloride in groundwater samples.

v. Total Dissolved Solids (TDS)

TDS ranges 600 mg/l to 2964 mg/l (Table 1, Fig.6) in the study area. As per BIS (IS 10500:2012) drinking water standards TDS is desirable <500 mg/l, permissible 500 mg/l - 2000 mg/l and non-potable >2000mg/l (Table 2). TDS is permissible in ten groundwater samples (Saunf-Kasni, Sanwar, Ranilla, Bhageswari, Achina, Sankror, Sanjarwas, Baund, Unn, Malkos) and non-potable in two groundwater samples (Misri, Baund Khurd).

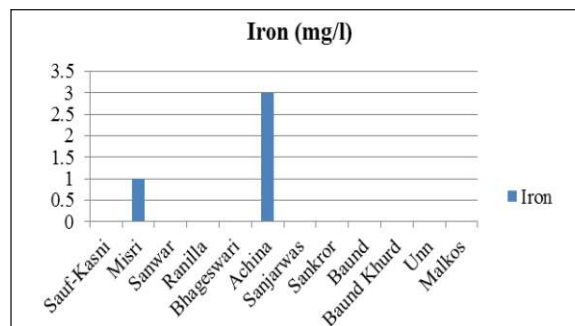
**Fig. 6: TDS in groundwater samples****vi. Fluoride**

In the study area fluoride ranges nil to 5 mg/l (Table 1, Fig.7). As per BIS (IS 10500:2012) drinking water standards fluoride is desirable <1.0 mg/l, permissible 1.0 mg/l-1.5mg/l and non-potable >1.5 mg/l (Table 2). Fluoride is desirable in two groundwater samples (Saunf-Kasni, Baund Khurd), permissible in three groundwater samples (Misri, Achina, Baund) and non-potable in seven groundwater samples (Sanwar, Ranilla, Bhageswari, Sankror, Sanjarwas, Unn, Malkos).

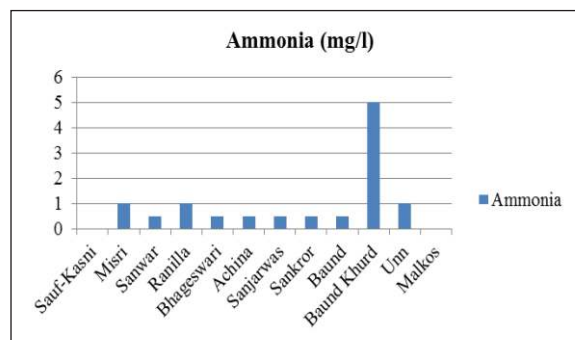
**Fig.7: Fluoride in groundwater samples.****vii. Iron**

In the study area iron ranges nil to 3 mg/l (Table 1, Fig.8). As per BIS (IS 10500:2012) drinking water standards iron is desirable <0.3 mg/l and non-potable >0.3 mg/l (Table 2). Iron is desirable in ten

groundwater samples (Saunf-Kasni, Sanwar, Ranilla, Bhageswari, Sankror, Sanjarwas, Baund, Baund Khurd, Unn, Malkos) and non-potable in two groundwater samples (Misri, Achina).

**Fig. 8: Iron in groundwater samples.****viii. Ammonia**

Ammonia ranges nil to 5 mg/l (Table 1, Fig.9) in the study area. As per BIS (IS 10500:2012) drinking water standards ammonia is desirable <0.5 mg/l and non-potable >0.5 mg/l (Table 2). Ammonia is desirable in eight groundwater samples (Saunf-Kasni, Sanwar, Achina, Bhageswari, Sankror, Sanjarwas, Baund, Malkos) and non-potable in four groundwater samples (Misri, Ranilla, Baund Khurd, Unn).

**Fig.9: Ammonia in groundwater samples.****ix. Nitrite**

In the study area nitrite ranges 0.2 mg/l to 1 mg/l (Table 1, Fig.10). As per BIS (IS 10500:2012) drinking water standards ammonia is desirable <1 mg/l and non-potable >1 mg/l (Table 2). Nitrite is desirable in all the twelve groundwater samples (Saunf-Kasni, Sanwar, Achina, Bhageswari, Sankror, Sanjarwas, Baund, Misri, Ranilla, Baund Khurd, Unn, Malkos).

x. Nitrate

In the study area nitrate ranges 45 mg/l to 100 mg/l (Table 1, Fig.11). As per BIS (IS 10500:2012) drinking water standards nitrate is desirable <45mg/l and non-potable >45mg/l (Table 2). Nitrate is desirable in three

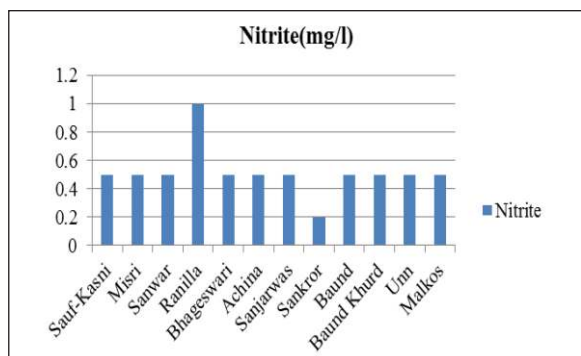


Fig.10: Nitrite in groundwater samples.

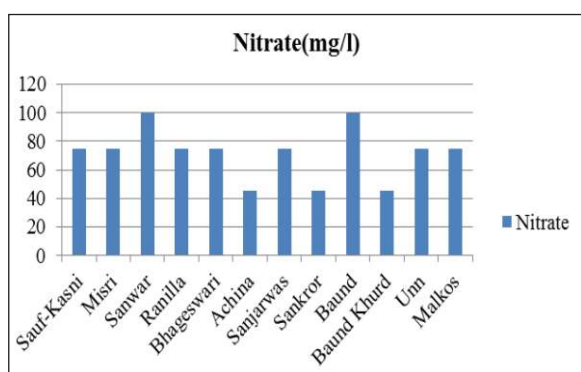


Fig.11: Nitrate in groundwater samples.

groundwater samples (Achina, Sankror, Baund Khurd) and non-potable in nine groundwater samples (Sauf-Kasni, Sanwar, Bhageswari, Sanjarwas, Baund, Misri, Ranilla, Unn, Malkos).

xi. Phosphate

Phosphate is nil in all the twelve groundwater samples (Table 1, Fig.12) in the study area. As per BIS (IS 10500:2012) drinking water standards phosphate is desirable <1.0 mg/l and non-potable >1.0 mg/l (Table 2). Phosphate is desirable in all the twelve groundwater samples (Sauf-Kasni, Sanwar, Achina, Bhageswari, Sankror, Sanjarwas, Baund, Misri, Ranilla, Baund Khurd, Unn, Malkos).

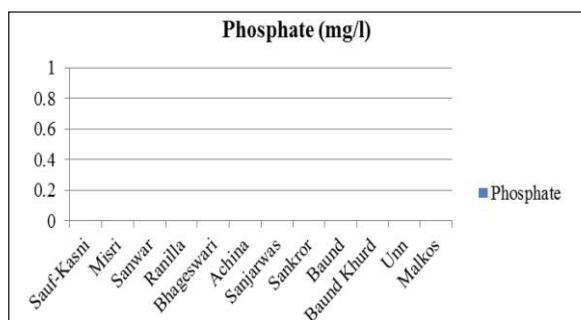


Fig.12: Phosphate in groundwater samples.

xii. Residual Chlorine

In the study area residual chlorine ranges nil to 0.2 mg/l (Table 1, Fig.13). As per BIS (IS 10500:2012) drinking water standards residual chlorine is desirable <0.2 mg/l, permissible 0.2mg/l-1.0 mg/l and non-potable >1.0 mg/l (Table 2). Residual Chlorine is desirable in nine groundwater samples (Sauf-Kasni, Sanwar, Achina, Bhageswari, Sankror, Sanjarwas, Baund, Misri, Ranilla) and permissible in three groundwater samples (Baund Khurd, Unn, Malkos).

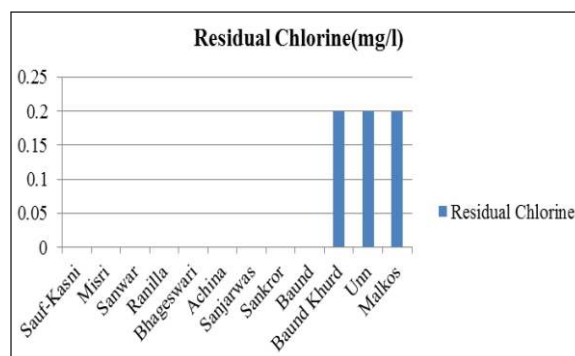


Fig.13: Residual Chlorine in groundwater samples.

CONCLUSIONS

In the study area pH, nitrite and phosphate is desirable in all the twelve groundwater samples. Alkalinity is desirable in two groundwater samples and permissible in ten groundwater samples. Hardness is desirable in one groundwater sample, permissible in nine groundwater samples and non-potable in three groundwater samples. Chloride is desirable in six groundwater samples, permissible in four groundwater samples and non-potable in two groundwater samples. TDS is permissible in ten groundwater samples and non-potable in two groundwater samples. Fluoride is desirable in two groundwater samples, permissible in three groundwater samples and non-potable in seven groundwater samples. Iron is desirable in ten groundwater samples and non-potable in two groundwater samples. Ammonia is desirable in eight groundwater samples and non-potable in four groundwater samples. Nitrate is desirable in three groundwater samples and non-potable in nine groundwater samples. Residual Chlorine is desirable in nine groundwater samples and permissible in three groundwater samples. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

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