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

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ABSTRACT

Water is important for living organisms on the Earth. Present development activities have put pressure on water resources. Groundwater is under more stress because of high exploitation for drinking, irrigation and industrial purposes. In the arid to semi-arid climatic zones groundwater is very important for sustaining day to day activities and agriculture and industrial purposes. The present study area Charkhi Dadri block in Charkhi Dadri district, Haryana was selected to study groundwater quality for drinking purpose. The geo-coordinates of the study area are latitudes 28.49° N to 28.70° N and longitudes 76.05° E to 76.47° E and covers an area of 396.57 sq. km. In the study area ten groundwater samples were collected in double capped 250 ml plastic bottles. Geo-coordinates of the sample locations were noted using mobile GPS. Chemical analysis of all the ten groundwater samples were done using Tamilnadu Water Supply and Drainage Board (TWAD), Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. Chemical analysis results were entered in excel software and prepared bar graphs. Result of groundwater samples analysis were compared with BIS (IS 10500:2012) drinking water standard to know the suitability of groundwater for drinking purpose. The study shows that pH ranges 7 to 8, alkalinity 200 mg/l to 450 mg/l, hardness 130 mg/l to 800 mg/l, chloride 40 mg/l to 1200 mg/l, TDS 552 mg/l to 2820 mg/l, fluoride 0.5 mg/l to 5 mg/l, iron nil to 0.3 mg/l, ammonia nil to 1 mg/l, nitrite 0.2 mg/l to 1 mg/l, nitrate 45 mg/l to 100 mg/l, phosphate nil in all the ten groundwater samples and residual chlorine nil to 0.2 mg/l. The study is highly useful for planning and monitoring of groundwater for drinking purpose in the study area.

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

INTRODUCTION

Water is important for survival of living beings on the Earth. Though plenty of water is available on the planet Earth but the useable amount for living beings is very less. In the present developmental activities demand of water is increased many folds. For drinking purpose good quality water either surface or groundwater is required but the availability of good quality water is again very less. Groundwater is easily available, hence, most exploited for

drinking, irrigation and industrial uses. In arid to semi-arid regions of the world groundwater is the main source for drinking, irrigation and industrial uses. The need of the hour is to assess good quality groundwater resources at least for drinking purpose. Nas and Berkay (2010), Machiwal et al. (2011), Sarala and Ravi Babu (2012), Singh and Kumar (2014), Spanos et al. (2014), Annapoorna and Janardhana (2015), Punia et al. (2015), Nelly and Mutua (2016), Vijaya Lalitha et al. (2016), Selvakumar et al.

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(2017), Chaudhary and Satheeshkumar (2018), Madhav et al. (2018), Bunkar and Kumar (2019), Jha et al. (2020), had done work on groundwater quality study for drinking purpose.

STUDY AREA

The study area Charkhi Dadri block in Charkhi Dadri district of Haryana is falling between the latitudes 28.49° N to 28.70° N and longitudes 76.05° E to 76.47° E and covers an area of 396.57 sq. km (Fig.1). Climate of the area is semi-arid type. Geologically the alluvium and blown sand present and geomorphologically alluvial plain and aeolian plain are present in the study area.

OBJECTIVE

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

MATERIALS AND METHODOLOGY

In the study area ten groundwater samples were collected in double capped 250 ml plastic bottle from hand pumps (HP) and tube wells (TW). Geo-coordinates of the sample locations were taken using mobile GPS. Chemical analysis of ten groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine (Table 1). Result of chemical analysis of groundwater samples were entered in excel software and prepared bar graphs. Result of groundwater samples analyses were compared with BIS (IS 10500:2012) drinking water standards (Table 2) to know the suitability of groundwater for drinking purpose.

Fig.1: Location map of the study area.

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

Sl No.	Sample Location	Latitude	Longitude	Source	pH	Alkalinity (mg/l)	Hardness (mg/l)	Chloride (mg/l)	TDS (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)
1.	Dadri	28.60	76.28	HP	7.5	450	800	450	2040	1.5	0	1	1	100	0	0
2.	Samaspur	28.65	76.37	HP	8	380	550	70	1200	1.5	0	1	0.5	75	0	0
3.	Morwala	28.64	76.39	HP	7	230	280	40	660	5	0.3	0	0.5	100	0	0
4.	Imlota	28.62	76.44	HP	8	330	800	850	2376	3	0	1	0.5	100	0	0
5.	Ghsola	28.56	76.26	HP	7	380	420	170	1164	5	0	0.5	0.2	45	0	0.2
6.	Makrani	28.49	76.27	TW	7.5	400	700	1070	2604	5	0	0.5	0.5	75	0	0.2
7.	AtelaKhurd	28.59	76.10	HP	7.5	280	130	50	552	0.5	0	0	0.2	45	0	0
8.	Charkhi	28.62	76.22	HP	7	200	400	100	840	5	0	0.5	0.5	75	0	0
9.	Dohki	28.66	76.16	HP	8	350	800	1200	2820	2	0	0.5	0.5	75	0	0
10.	Chhapar	28.63	76.11	TW	8	420	600	1100	2544	1.5	0	0.5	1	75	0	0

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

S. No.	Constituent	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 7 to 8 (Table 1, Fig.2). As per BIS (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 ten groundwater samples (Dadri, Samaspur, Morwala, Imlota, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar) in the study area.

Fig. 2: pH in groundwater samples.

ii. Alkalinity

In the study area alkalinity ranges 200 mg/l to 450 mg/l (Table 1, Fig.3). As per BIS (10500:2012) drinking water standards alkalinity is desirable <200 mg/l, permissible between the range 200 mg/l-600 mg/l and non-potable >600 mg/l (Table 2). Alkalinity is permissible in all the ten groundwater samples (Dadri,

Samaspur, Morwala, Imlota, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar) in the study area.

Fig. 3: Alkalinity in groundwater samples

iii. Hardness

Hardness ranges 130 mg/l to 800 mg/l (Table 1, Fig.4) in the study area. As per BIS (10500:2012) drinking water standards hardness is desirable if less than 200 mg/l, permissible between the range 200 mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Hardness is desirable in one groundwater sample (Atela Khurd), permissible in five groundwater samples (Samaspur, Morwala, Ghasola, Charkhi, Chhapar) and non-potable in four groundwater samples (Dadri, Imlota, Makrani, Dohki) in the study area.

Fig. 4: Hardness in groundwater samples.

iv. Chloride

In the study area chloride ranges 40 mg/l to 1200 mg/l (Table 1, Fig.5). As per BIS (10500:2012) drinking water standards chloride is desirable if less than 250 mg/l, permissible between the range 250 mg/l-1000mg/l and non-potable if more than 1000mg/l (Table 2). Chloride is desirable in five groundwater samples (Samaspur, Morwala, Ghasola, Atela Khurd, Charkhi), permissible in two groundwater samples (Dadri, Imlota) and non-potable in three groundwater samples (Makrani, Dohki, Chhapar) in the study area.

Fig. 5: Chloride in groundwater samples.

v. Total Dissolved Solids (TDS)

In the study area TDS ranges 552 mg/l to 2820 mg/l (Table 1, Fig.6). As per BIS (10500:2012) drinking water standards TDS is desirable if less than 500 mg/l, permissible between the range 500 mg/l - 2000 mg/l and non-potable if more than 2000 mg/l (Table 2). In the study area TDS is permissible in five groundwater samples (Samaspur, Morwala, Ghasola, Atela Khurd, Charkhi) and non-potable in five groundwater samples (Dadri, Imlota, Makrani, Dohki, Chhapar).

vi. Fluoride

In the study area fluoride ranges 0.5 mg/l to 5 mg/l

Fig. 6: TDS in groundwater samples.

Fig. 7: Fluoride in groundwater samples.

(Table 1, Fig.7). As per BIS (10500:2012) drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between the range 1.0 mg/l - 1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is desirable in one groundwater sample (Atela Khurd), permissible in three groundwater samples (Dadri, Samaspur, Chhapar) and non-potable in six groundwater samples (Morwala, Imlota, Ghasola, Makrani, Charkhi, Dohki) in the study area.

vii. Iron

In the study area iron ranges nil to 0.3 mg/l (Table 1, Fig.8). As per BIS (10500:2012) drinking water standards iron is desirable if less than 0.3 mg/l and non-potable if more than 0.3 mg/l (Table 2). In the study area iron is desirable in all the ten groundwater samples (Dadri, Samaspur, Morwala, Imlota, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar).

Fig. 8: Iron in groundwater samples.

viii. Ammonia

Ammonia ranges nil to 1 mg/l (Table 1, Fig.9) in the study area. As per BIS (10500:2012) drinking water standards ammonia is desirable if less than 0.5 mg/l and non-potable if more than 0.5 mg/l (Table 2). Ammonia is desirable in seven groundwater samples (Morwala, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar) and non-potable in three groundwater samples (Dadri, Samaspur, Imlota) in the study area.

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 (10500:2012) drinking water standards nitrite is desirable if less than 1 mg/l and non-potable if more than 1 mg/l (Table 2). In the study area nitrite is desirable in all the ten groundwater samples (Dadri, Samaspur, Morwala, Imlota, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar).

Fig. 10: Nitrite in groundwater samples.

x. Nitrate

In the study area nitrate ranges 45 mg/l to 100 mg/l (Table 1, Fig.11). As per BIS (10500:2012) drinking water standards nitrate is desirable if less than 45mg/l and non-potable if more than 45mg/l (Table 2). Nitrate is desirable in two groundwater samples

(Ghasola, Atela Khurd) and non-potable in eight groundwater samples (Dadri, Samaspur, Morwala, Imlota, Makrani, Charkhi, Dohki, Chhapar) in the study area.

Fig. 11: Nitrate in groundwater samples.

xi. Phosphate

In the study area phosphate is nil in all the ten groundwater samples (Table 1, Fig.12). As per BIS (10500:2012) drinking water standards phosphate is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). In the study area phosphate is desirable in all the ten groundwater samples (Dadri, Samaspur, Morwala, Imlota, Ghasola, Makrani, Atela Khurd, Charkhi, Dohki, Chhapar).

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 (10500:2012) drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible between the range 0.2 mg/l-1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). In the study area residual chlorine is desirable in eight groundwater samples (Dadri, Samaspur, Morwala, Imlota, Atela Khurd, Charkhi, Dohki, Chhapar) and permissible in two groundwater samples (Ghasola, Makrani).

Fig. 13: Residual Chlorine in groundwater samples.

CONCLUSIONS

In the study area pH, iron, nitrite and phosphate is desirable in all the ten groundwater samples while alkalinity is permissible in all the ten groundwater samples. Hardness is desirable in one groundwater sample, permissible in five groundwater samples and non-potable in four groundwater samples. Chloride is desirable in five groundwater samples, permissible in two groundwater samples and non-potable in three groundwater samples. TDS is permissible in five groundwater samples as well as non-potable in five groundwater samples. Fluoride is desirable in one groundwater sample, permissible in three groundwater samples and non-potable in six groundwater samples. Ammonia is desirable in seven groundwater samples and non-potable in three groundwater samples. Nitrate is desirable in two groundwater samples and non-potable in eight groundwater samples. Residual Chlorine is desirable in eight groundwater samples and permissible in two groundwater samples. This study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

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