

ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING PURPOSE IN SIWAN BLOCK, KAITHAL DISTRICT, HARYANA

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Abstract

The study area Siwan block is located in Kaithal district of Haryana state. The geo-coordinates of the study area are latitudes 29.83° N to 29.99° N and longitudes 76.17° E to 76.45° E and covers an area of 291.49 sq. km. Geologically alluvium and geomorphologically alluvial plain are present. The main objective was to assess groundwater quality for drinking purpose in the study area. In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells. Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, 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. Results of groundwater samples analysis were compared with BIS (IS 10500:2012) drinking water standards to know groundwater quality for drinking purpose. In the study area pH ranges 7 to 8, alkalinity 260 mg/l to 510 mg/l, hardness 70 mg/l to 340 mg/l, chloride 50 mg/l to 70 mg/l, TDS 480 mg/l to 996 mg/l, fluoride 1.0 mg/l to 5.0 mg/l, iron nil in all the eight groundwater samples, ammonia nil to 0.5 mg/l, nitrite 0.2 mg/l to 0.5 mg/l, nitrate 75 mg/l to 100 mg/l, phosphate and residual chlorine nil in all the eight groundwater samples. The study is highly useful for planning and monitoring of groundwater quality in the study area.

Keywords

Groundwater, quality, drinking, Siwan, Kaithal, Haryana.

INTRODUCTION

Water is important for survival of living beings, irrigation and industrial uses. Increasing population, industrialisation and irrigation practices have put pressure on the availability and quality of water. Groundwater is available, hence, more vulnerable to quality deterioration due to anthropogenic activities. In agriculture dominant areas farmers are using manures and herbicides in excess which ultimately deteriorated the groundwater quality. Many workers (Sarala et al. (2012), Singh and Kumar (2014), Spanos et al. (2014), Annapoorna and Janardhana (2015), Punia et al. (2015), Choudhary et al. (2016), Vijaya Lalitha et al. (2016), Lalitha et al. (2017), Madhav et al. (2018)) had done work on groundwater quality assessment for drinking purpose in different areas.

STUDY AREA

The study area Siwan block is located in Kaithal district of Haryana (Fig.1). The geo-coordinates of the study area are latitudes 29.83° N to 29.99° N and longitudes 76.17° E to 76.45° E and covers an area of 291.49 sq. km. In the study area geologically alluvium and geomorphologically alluvial plain are present.

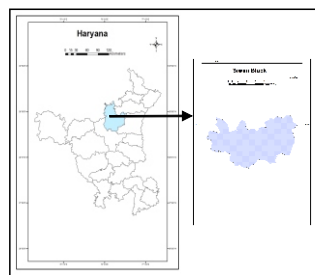


Fig.1: Location map of the study area.

OBJECTIVE

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

MATERIALS AND METHODOLOGY

In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells (TW). Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and

Drainage (TWAD) Board, 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 (Table 1). Chemical analysis of groundwater samples were entered in excel software and prepared bar graphs for each chemical parameter. Results of groundwater samples analysis were compared with BIS (IS 10500:2012) drinking water standards (Table 2) to know groundwater quality for drinking purpose.

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

| S. 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 | Nagal | 29.89 | 76.28 | TW | 7 | 330 | 230 | 50 | 732 | 1.5 | 0 | 0 | 0.2 | 75 | 0 | 0 |
| 2 | Sontha | 29.92 | 76.34 | TW | 7.5 | 290 | 240 | 50 | 696 | 1 | 0 | 0.5 | 0.5 | 75 | 0 | 0 |
| 3 | Attela | 29.85 | 76.29 | TW | 8 | 370 | 270 | 70 | 852 | 1 | 0 | 0 | 0.5 | 100 | 0 | 0 |
| 4 | Kasour | 29.96 | 76.22 | TW | 7.5 | 270 | 270 | 70 | 828 | 1.5 | 0 | 0 | 0.5 | 75 | 0 | 0 |
| 5 | Andhli | 29.91 | 76.25 | TW | 7.5 | 260 | 200 | 70 | 624 | 1.5 | 0 | 0.5 | 0.5 | 75 | 0 | 0 |
| 6 | Dohar | 29.87 | 76.43 | TW | 8 | 510 | 140 | 70 | 864 | 5 | 0 | 0.5 | 0.5 | 75 | 0 | 0 |
| 7 | Rasulpur | 29.92 | 76.42 | TW | 7 | 290 | 70 | 70 | 480 | 1.5 | 0 | 0 | 0.2 | 75 | 0 | 0 |
| 8 | Kheri Gulamali | 29.88 | 76.30 | TW | 7.5 | 420 | 340 | 70 | 996 | 2 | 0 | 0.5 | 0.2 | 75 | 0 | 0 |

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

| Sl. No. | Parameters | Potable | | Non potable |
|---------|-------------------------------|-----------|-------------|---------------|
| | | Desirable | Permissible | |
| 1. | pH | 6.5-8.5 | - | <6.5 and >8.5 |
| 2. | Alkalinity (mg/l) | 200 | 200-600 | >600 |
| 3. | Hardness (mg/l) | 200 | 200-600 | >600 |
| 4. | Chloride (mg/l) | 250 | 250-1000 | >1000 |
| 5. | Total Dissolved Solids (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) | <0.1 | - | >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 (IS 10500:2012) drinking water standards pH is desirable between 6.5 to 8.5 and non-potable if less than 6.5 and more than 8.5 (Table 2). pH is desirable in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

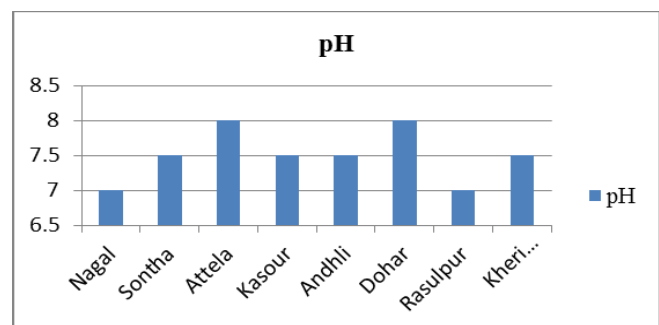


Fig.2: pH in groundwater samples.

ii. Alkalinity

In the study area alkalinity ranges 260 mg/l to 510 mg/l (Table 1, Fig.3). As per BIS (IS 10500:2012) drinking water standards alkalinity is desirable if less than 200 mg/l, permissible between 200 mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Alkalinity is permissible in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

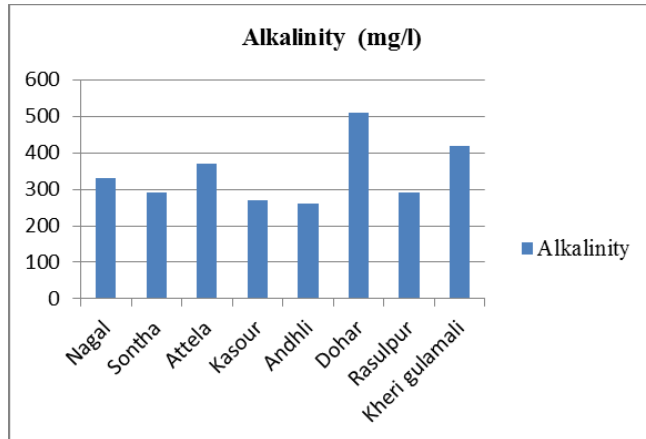


Fig. 3: Alkalinity in groundwater samples.

iii. Hardness

In the study area hardness ranges 70 mg/l to 340 mg/l (Table 1, Fig.4). As per BIS (IS 10500:2012) drinking water standards hardness is desirable if less than 200 mg/l, permissible between 200 mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Hardness is desirable in two groundwater samples (Dohar, Rasulpur) and permissible in six groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Kheri Gulamali).

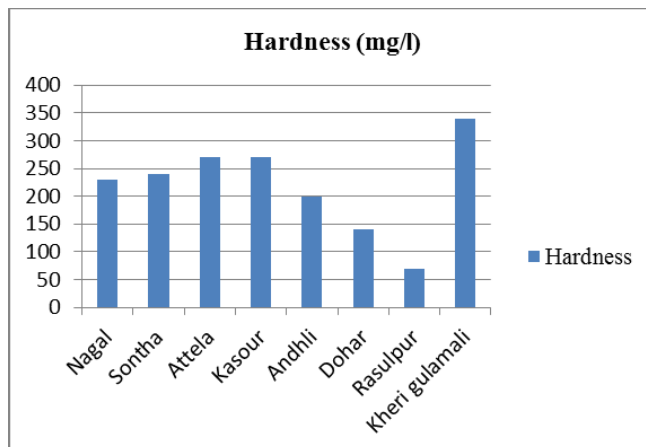


Fig.4: Hardness in groundwater samples.

iv. Chloride

In the study area chloride ranges 50 mg/l to 70 mg/l (Table 1, Fig.5). As per BIS (IS 10500:2012) drinking water standards chloride is desirable if less than 250 mg/l, permissible between 250mg/l-1000 mg/l and non-potable if more than 1000 mg/l (Table 2). Chloride is desirable in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

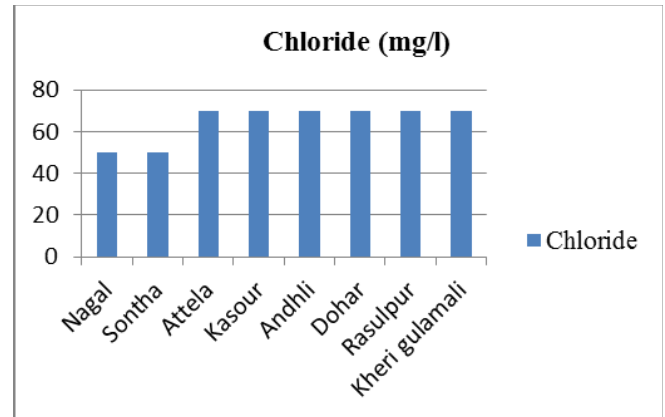


Fig. 5: Chloride in groundwater samples.

v. Total Dissolved Solids (TDS)

In the study area TDS ranges 480 mg/l to 996 mg/l (Table 1, Fig.6). As per BIS (IS 10500:2012) drinking water standards TDS is desirable if less than 500 mg/l, permissible between 500mg/l-2000 mg/l and non-potable if more than 2000 mg/l (Table 2). TDS is desirable in one groundwater sample (rasulpur) and permissible in seven groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Kheri Gulamali).

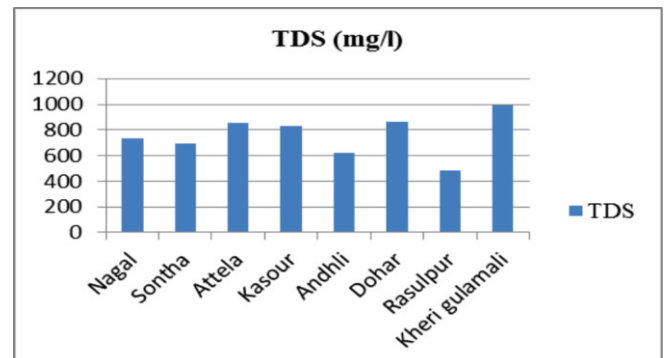


Fig. 6: TDS in groundwater samples.

vi. Fluoride

In the study area fluoride ranges 1.0 mg/l to 5.0 mg/l (Table 1, Fig.7). As per BIS (IS 10500:2012) drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between 1.0 mg/l -1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is permissible in six groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Rasulpur) and non-potable in two groundwater samples (Dohar (5 mg/l), Kheri Gulamali (2 mg/l)).

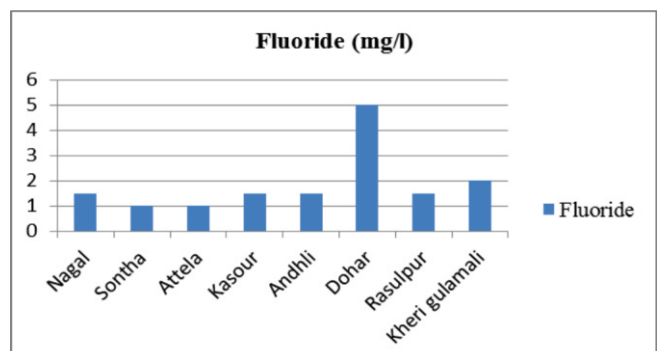


Fig.7: Fluoride in groundwater samples.

vii. Iron

In the study area iron is nil in all the eight groundwater samples (Table 1, Fig.8). As per BIS (IS 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). Iron is desirable in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

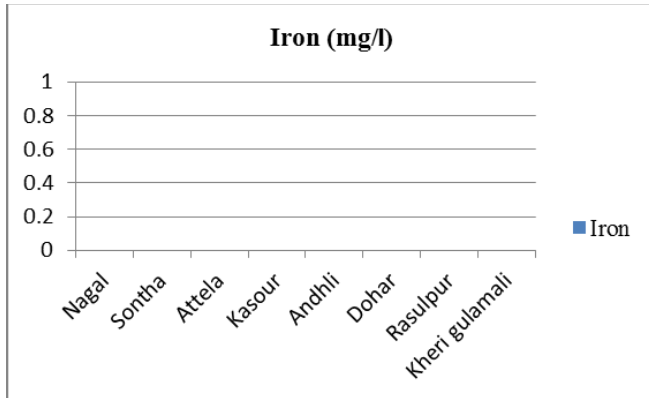


Fig. 8: Iron in groundwater samples.

viii. Ammonia

In the study area ammonia ranges nil to 0.5 mg/l (Table 1, Fig.9). As per BIS (IS 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 all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

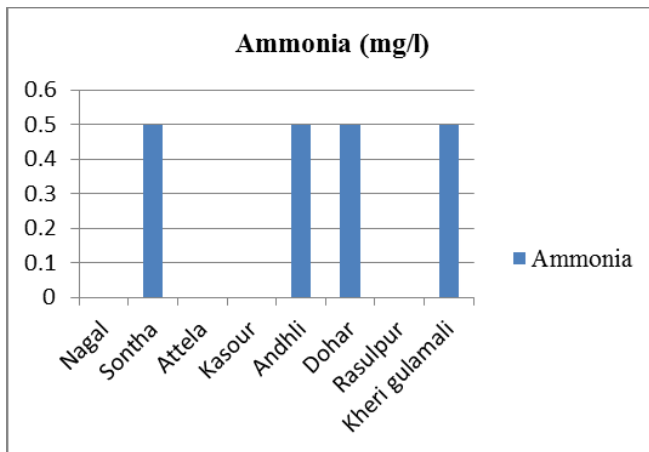


Fig.9: Ammonia in groundwater samples.

ix. Nitrite

In the study area nitrite ranges 0.2 mg/l to 0.5 mg/l (Table 1, Fig.10). As per BIS (IS 10500:2012) drinking water standards nitrite is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Nitrite is desirable in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

x. Nitrate

In the study area nitrate ranges 75 mg/l to 100 mg/l (Table 1, Fig.11). As per BIS (IS 10500:2012) drinking water standards nitrate is desirable if less than 45 mg/l and non-potable if more than 45 mg/l (Table 2). Nitrate is non-potable in all eight groundwater samples (Nagal (75 mg/l), Sontha (75 mg/l),

Attela (100 mg/l), Kasour(75 mg/l), Andhli (75 mg/l), Dohar (75 mg/l), Rasulpur (75 mg/l), Kheri Gulamali (75 mg/l)).

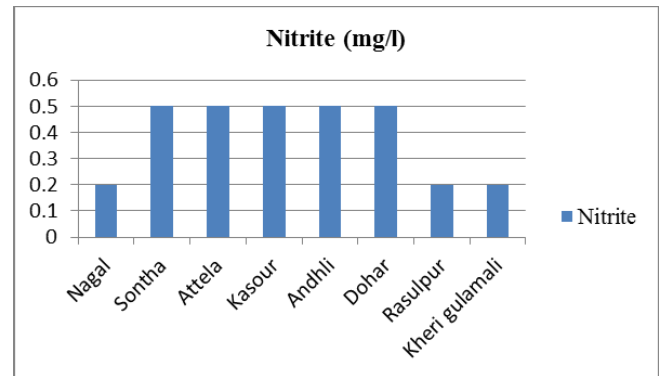


Fig.10: Nitrite in groundwater samples.

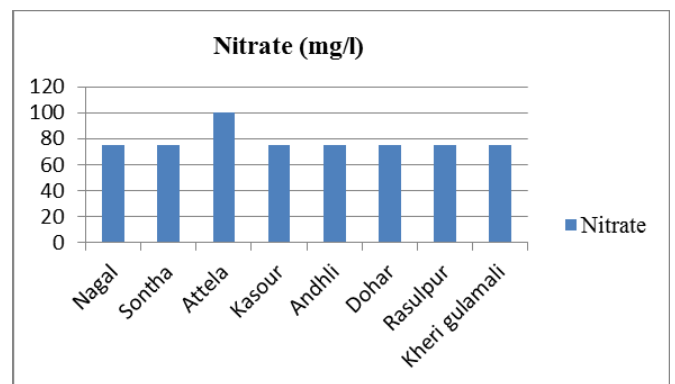


Fig.11: Nitrate in groundwater samples.

xi. Phosphate

In the study area phosphate is nil in all the eight groundwater samples (Table 1, Fig.12). As per BIS (IS 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). Phosphate is desirable in all eight groundwater samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

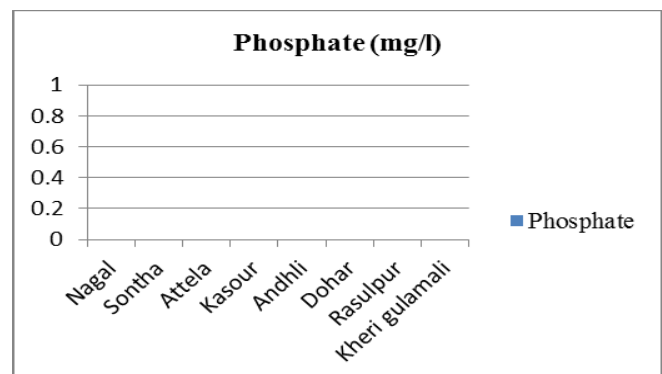


Fig.12: Phosphate in groundwater samples.

xii. Residual Chlorine

In the study area residual chlorine is nil in all the eight groundwater samples (Table 1, Fig.13). As per BIS (IS 10500:2012) drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible between 0.2-1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Residual chlorine is desirable in all eight groundwater

samples (Nagal, Sontha, Attela, Kasour, Andhli, Dohar, Rasulpur, Kheri Gulamali).

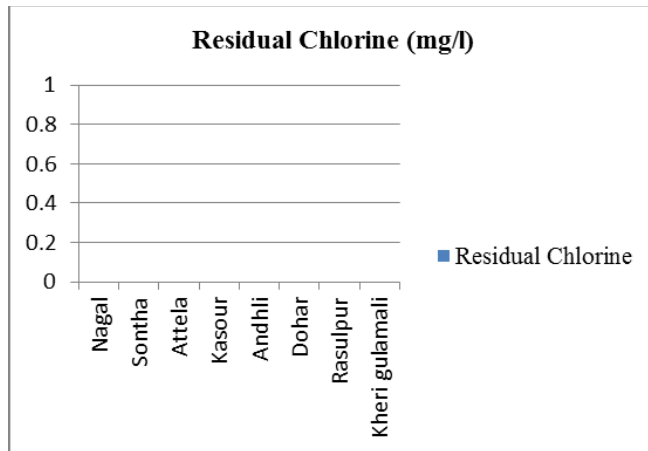


Fig. 13: Residual Chlorine in groundwater samples.

CONCLUSIONS

In the study area pH, chloride, iron, ammonia, nitrite, phosphate and residual chlorine are desirable in all eight groundwater samples. Alkalinity is permissible in all eight groundwater samples. Hardness is desirable in two groundwater samples and permissible in six groundwater samples. TDS is desirable in one groundwater sample and permissible in seven groundwater samples. Fluoride is permissible in six groundwater samples and non-potable in two groundwater samples. Nitrate is non-potable in all eight groundwater samples. The study is highly useful for planning and monitoring of groundwater quality in the study area.

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