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

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ABSTRACT

Water is important for survival of living beings and non-living developmental activities. In the present developmental scenario requirement of water is increasing very fast. In arid to semi-arid regions groundwater is very important for fulfilling the need of people. Badhra block is falling in Charkhi Dadri district of Haryana state, India. The climate of the block is semi-arid. Groundwater is the main source for drinking and irrigation purpose. In the study area ten groundwater samples were collected in the month of January, 2019. Groundwater samples were analyzed using field water testing kit prepared by Tamilnadu Water Supply and Drainage Board, Chennai for twelve chemical parameters-pH, alkalinity, hardness, chloride, total dissolved solids, fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. In the groundwater samples pH varies from 7 to 7.5, alkalinity 250-450 mg/l, hardness 70 - 580 mg/l, chloride 60-600 mg/l, total dissolved solids (TDS) 564-1704 mg/l, fluoride 0.5-3 mg/l, iron nil in all groundwater samples, ammonia nil to 1 mg/l, nitrite 0.2-0.5 mg/l, nitrate 45-75mg/l, phosphate nil to 0.5 mg/l, residual chlorine nil in all ten groundwater samples. Groundwater is potable in one sample taken at Dalawas and non-potable in nine groundwater samples taken at Lad (fluoride 2 mg/l, ammonia 1mg/l, nitrate 75mg/l), Badhara (fluoride 3mg/l), Kari (nitrate 75mg/l), Sisrli (nitrate 75mg/l), Dandma (nitrate 75mg/l), Jeoli (nitrite 75 mg/l), Mandi (nitrate 75 mg/l), Rahrodi (nitrate 75mg/l), Dohka (nitrate 75mg/l). The study is highly useful for monitoring of groundwater quality for drinking purpose.

INTRODUCTION

Water is important for survival of living beings on the planet Earth. Besides requirement for living beings, other activities like agriculture and industry are also dependent on water. In arid to semi-arid regions groundwater is very important because of less availability of surface water. Groundwater quality plays vital role in its use for various purposes. Drinking water for human consumption should be as per drinking water standards to avoid health problems. But in the present context of developmental activities availability of good quality groundwater is very less. Many workers have studied groundwater quality in different types of terrain conditions (Hussain and Prasad Rao (2013), Prasad et al. (2014), Moghaddam et al (2018), VijayaLalitha and Sai Tejaswini (2017), Chaudhary et al. (2015), Perween and Fatima (2015), Rani and Chaudhary (2015), Celestino et al. (2018)).

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STUDY AREA
Badhra block is located in Charkhi Dadri district of Haryana state, India. Geologically the block has blown sand of recent age. Aeolian plain and sand dunes are geomorphologic features found in the block. The climate of the block is semi-arid type.

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

MATERIALS AND METHODOLOGY
In the study area ten groundwater samples were collected in plastic double capped bottles in the month of January 2019. All the ten groundwater samples were analyzed using field water testing kit prepared by Tamilnadu Water Supply and Drainage Board, Chennai for twelve chemical parameters—pH, alkalinity, hardness, chloride, total dissolved solids, fluoride, iron, nitrite, nitrate, phosphate and residual chlorine. Results of chemical analysis were compared with BIS drinking water standards (IS 10500:2012) to know potable and non-potable of groundwater samples. The chemical analysis data were entered in Excel software and prepared bar graphs of each chemical parameter.

RESULTS AND DISCUSSION
Chemical analysis results of groundwater samples are given in table 1, BIS drinking water standards in table 2 and graphical representation of results in fig. 1 to fig. 12.

<table>
<thead>
<tr>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>pH</th>
<th>Alkalinity (mg/l)</th>
<th>Hardness (mg/l)</th>
<th>Chloride (mg/l)</th>
<th>TDS (mg/l)</th>
<th>Fluoride (mg/l)</th>
<th>Iron (mg/l)</th>
<th>Ammonia (mg/l)</th>
<th>Nitrite (mg/l)</th>
<th>Nitrite (mg/l)</th>
<th>Phosphate (mg/l)</th>
<th>Residual Chlorine (mg/l)</th>
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<tr>
<td>Lad</td>
<td>28°28'52&quot;</td>
<td>75°54'23&quot;</td>
<td>7.5</td>
<td>390</td>
<td>100</td>
<td>90</td>
<td>696</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0.5</td>
<td>75</td>
<td>0</td>
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<tr>
<td>Badhara</td>
<td>28°31'3&quot;</td>
<td>75°55'33&quot;</td>
<td>7.5</td>
<td>450</td>
<td>70</td>
<td>200</td>
<td>864</td>
<td>3</td>
<td>0</td>
<td>0.5</td>
<td>0.2</td>
<td>45</td>
<td>0</td>
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<tr>
<td>Kari</td>
<td>28°31'32&quot;</td>
<td>75°54'51&quot;</td>
<td>7.5</td>
<td>450</td>
<td>100</td>
<td>180</td>
<td>876</td>
<td>1.5</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>75</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Noeli</td>
<td>28°35'41&quot;</td>
<td>75°52'55&quot;</td>
<td>7.5</td>
<td>450</td>
<td>350</td>
<td>400</td>
<td>1416</td>
<td>1</td>
<td>0</td>
<td>0.5</td>
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<td>75</td>
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<td>Dandma</td>
<td>28°34'42&quot;</td>
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<td>7.5</td>
<td>370</td>
<td>580</td>
<td>470</td>
<td>1704</td>
<td>1</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>75</td>
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<tr>
<td>Jeoli</td>
<td>28°31'33&quot;</td>
<td>75°57'31&quot;</td>
<td>7.2</td>
<td>250</td>
<td>150</td>
<td>130</td>
<td>636</td>
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<td>75</td>
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<td>Dalawas</td>
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<td>75°59'15&quot;</td>
<td>7.5</td>
<td>340</td>
<td>190</td>
<td>140</td>
<td>804</td>
<td>1</td>
<td>0</td>
<td>0.5</td>
<td>0.2</td>
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<td>0</td>
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<tr>
<td>Mandi</td>
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<td>76°12'27&quot;</td>
<td>7.5</td>
<td>280</td>
<td>150</td>
<td>100</td>
<td>636</td>
<td>1.5</td>
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<td>0.5</td>
<td>0.5</td>
<td>75</td>
<td>0</td>
<td>0</td>
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<td>Rahrodi</td>
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<td>76°3'2&quot;</td>
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<td>270</td>
<td>140</td>
<td>60</td>
<td>564</td>
<td>1</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>75</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Dohka</td>
<td>28°36'49&quot;</td>
<td>76°4'41&quot;</td>
<td>7.5</td>
<td>310</td>
<td>370</td>
<td>600</td>
<td>1536</td>
<td>0.5</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>75</td>
<td>0</td>
<td>0</td>
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<table>
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<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>Desirable</th>
<th>Potable</th>
<th>Permissible</th>
<th>Non-Potable</th>
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<tr>
<td>1</td>
<td>pH</td>
<td>6.5 to 8.5</td>
<td>-</td>
<td>&lt;6.5 to &gt;8.5</td>
<td>&gt;600</td>
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<tr>
<td>2</td>
<td>Total Hardness (mg/l)</td>
<td>&lt;200</td>
<td>200-600</td>
<td>&gt;600</td>
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<tr>
<td>3</td>
<td>Iron (mg/l)</td>
<td>&lt;0.3</td>
<td>-</td>
<td>&gt;0.3</td>
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<tr>
<td>4</td>
<td>Chloride (mg/l)</td>
<td>&lt;250</td>
<td>250-1000</td>
<td>&gt;1000</td>
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</tr>
<tr>
<td>5</td>
<td>Total Dissolved Solids (mg/l)</td>
<td>&lt;500</td>
<td>500-2000</td>
<td>&gt;2000</td>
<td></td>
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<tr>
<td>6</td>
<td>Nitrate (mg/l)</td>
<td>&lt;45</td>
<td>-</td>
<td>&gt;45</td>
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</tr>
<tr>
<td>7</td>
<td>Nitrite (mg/l)</td>
<td>&lt;1.0</td>
<td>-</td>
<td>&gt;1.0</td>
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<tr>
<td>8</td>
<td>Fluoride (mg/l)</td>
<td>&lt;1.0</td>
<td>1.0-1.5</td>
<td>&gt;1.5</td>
<td></td>
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<tr>
<td>9</td>
<td>Phosphate (mg/l)</td>
<td>&lt;1.0</td>
<td>-</td>
<td>&gt;1.0</td>
<td></td>
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<tr>
<td>10</td>
<td>Residual Chlorine (mg/l)</td>
<td>&lt;0.2</td>
<td>0.2-1</td>
<td>&gt;1.0</td>
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<tr>
<td>11</td>
<td>Ammonia (mg/l)</td>
<td>&lt;0.5</td>
<td>-</td>
<td>&gt;0.5</td>
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<tr>
<td>12</td>
<td>Alkalinity (mg/l)</td>
<td>&lt;200</td>
<td>200-600</td>
<td>&gt;600</td>
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</tbody>
</table>
I. **pH**: In the study area pH varies 7-7.5 in all ten groundwater samples. pH is desirable (6.5-8.5) in all ten groundwater samples (Table 1, Table 2 and Fig.1).

![pH in groundwater samples](image)

**Fig.1: pH in groundwater samples.**

**ii. Alkalinity**: In the study area alkalinity varies 250-450 mg/l in all ten groundwater samples. Alkalinity is permissible (200-600 mg/l) in all ten groundwater samples (Table 1, Table 2 and Fig.2).

![Alkalinity in groundwater samples](image)

**Fig.2: Alkalinity in groundwater samples.**

**iii. Hardness**: In the study area hardness varies 70 - 580 mg/l in all ten groundwater samples. Hardness is desirable (<200 mg/l) in seven groundwater samples and permissible (200-600 mg/l) in three groundwater samples (Table 1, Table 2 and Fig.3).

![Hardness in groundwater samples](image)

**Fig.3: Hardness in groundwater samples.**

iv. **Chloride**: Chloride varies 60-600 mg/l in all ten groundwater samples in the study area. In seven groundwater samples chloride is desirable (<250 mg/l) and in three groundwater samples permissible (250-1000 mg/l) (Table 1, Table 2 and Fig.4).

![Chloride in groundwater samples](image)

**Fig. 4: Chloride in groundwater samples.**

**v. Total Dissolved Solids**: Total dissolved solids (TDS) varies 564 -1704 mg/l in all ten groundwater samples. TDS is permissible (500-2000 mg/l) in all ten groundwater samples in the study area (Table 1, Table 2 and Fig.5).

![Total dissolved solids (TDS) in groundwater samples](image)

**Fig. 5: Total dissolved solids (TDS) in groundwater samples**

**vi. Fluoride**: In the study area fluoride varies 0.5-3 mg/l in all ten groundwater samples. Fluoride is desirable (<1 mg/l) in six groundwater samples, permissible (1-1.5 mg/l) in two groundwater samples and non-potable (>1.5 mg/l) in two groundwater samples (Table 1, Table 2 and Fig.6).

![Fluoride in groundwater samples](image)

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

**vii. Iron**: In the study area iron is nil in all ten groundwater samples, hence, iron is desirable (<0.3 mg/l) in all ten groundwater samples (Table 1, Table 2 and Fig.7).

![Iron in groundwater samples](image)

**Fig. 7: Iron in groundwater samples.**
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viii. Ammonia: Ammonia varies nil to 1 mg/l in all ten groundwater samples in the study area. Ammonia is desirable (<0.5 mg/l) in nine groundwater samples and non-potable (>0.5 mg/l) in one groundwater sample (Table 1, Table 2 and Fig.8).

Fig. 6: Fluoride in groundwater samples.

Fig. 7: Iron in groundwater samples.

Fig. 8: Ammonia in groundwater samples.

ix. Nitrite: In the study area nitrite varies 0.2-0.5 mg/l in all ten groundwater samples. Nitrite is desirable (<1mg/l) in all ten groundwater samples (Table 1, Table 2 and Fig.9).

x. Nitrate: In the study area nitrate varies 45-75 mg/l in all ten groundwater samples. Nitrate is desirable (<45mg/l) in two groundwater samples and non-potable (>45mg/l) in eight groundwater samples (Table 1, Table 2 and Fig.10).

xi. Phosphate: In the study area phosphate varies nil to 0.5 mg/l in all ten groundwater samples. Phosphate is desirable (<1 mg/l) in all ten groundwater samples in the study area (Table 1, Table 2 and Fig.11).

Fig. 9: Nitrite in groundwater samples.

Fig. 10: Nitrate in groundwater samples.

Fig. 11: Phosphate in groundwater samples.
Residual Chlorine: Residual chlorine is nil in all ten groundwater samples in the study area, hence, residual chlorine is desirable (<0.2 mg/l) in all ten groundwater samples (Table 1, Table 2 and Fig.12).

CONCLUSIONS
Groundwater is potable in one groundwater sample taken at Dalawas and non-potable in nine groundwater samples taken at Lad (fluoride 2 mg/l, ammonia 1 mg/l, nitrate 75 mg/l), Badhara (fluoride 3 mg/l), Kari (nitrate 75 mg/l), Sisrli (nitrate 75 mg/l), Dandma (nitrate 75 mg/l), Jeoli (nitrate 75 mg/l), Mandi (nitrate 75 mg/l), Rahrodi (nitrate 75 mg/l), Dohka (nitrate 75 mg/l). The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

REFERENCES