Data Article

Data on groundwater quality, scaling potential and corrosiveness of water samples in Torbat-e-Heydariyeh rural drinking water resources, Khorasan-e-Razavi province, Iran

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A R T I C L E  I N F O

Article history:
Received 21 February 2018
Received in revised form
17 June 2018
Accepted 19 June 2018
Available online 26 June 2018

A B S T R A C T

According to World Health Organization guidelines, corrosion control is an important aspect of safe drinking-water supplies. The data presented is physical and chemical parameters of drinking water in the rural areas of Torbat-e-Heydariyeh city, also to determine corrosion indices. This cross-sectional study has carried out with 188 taken samples during 2014 with 13 parameters,
which has been analyzed based on standard method. Also with regard to standard conditions, result of this paper is compared with Environmental Protection Agency and Iran national standards. Five indices, Langlier Saturation Index (LSI), Ryznar Stability Index (RSI), Puckorius Scaling Index (PSI), Larson-Skold Index (LS) and Aggressive Index (AI), programmed by using Microsoft Excel software. Owing to its simplicity, the program can easily be used by researchers and operators. Parameters included Sulfate, Sodium, Chloride, and Electrical Conductivity respectively was 13.5%, 28%, 10.5%, and 15% more than standard level. The amounts of Nitrate, in 98% of cases were in permissible limits and about 2% were more than standard level. Result of presented research indicate that water is corrosive at 10.6%, 89.4%, 87.2%, 59.6% and 14.9% of drinking water supply reservoirs, according to LSI, RSI, PSI, LS and AI, respectively.

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| Specifications Table |
|----------------------|
| **Subject area**     | Chemistry |
| **More specific subject area** | Chemistry of groundwater |
| **Type of data**     | Table and figure |
| **How data was acquired** | Experiments conducted in two general categories of device experiments and Titration. Titration Experiment includes temporary and permanent hardness, magnesium, calcium and chloride, Device Experiment consist of pH (model wtw, Esimmetrwb), Electrical conductivity, Turbidity (model Hach50161/co150model P2100Hach, USA), Fluorine, nitrate, sulfate |
| **Data format**      | Raw, Analyzed |
| **Experimental factors** | 188 samples from 47 water sources were taken, 18 parameters were evaluated according to the standard method, and compared with Iran and EPA water standards. Experiments conducted in two general categories of device experiments and Titration. |
| **Experimental features** | Titration Experiment includes temporary and permanent hardness, magnesium, calcium and chlorides, Device Experiment consist of pH, Electrical conductivity, Turbidity, Fluorine, nitrate, sulfate. |
| **Data source location** | Torbat-e-Heydariyeh, Razavi Khorasan Province, Iran |
| **Data accessibility** | Data are included in this article |

**Value of the data**

- Determination of the physical and chemical parameter including EC, TDS, TH, CaH, pH, Turbidity, Cl⁻, NO₃⁻, SO₄²⁻, F, Na⁺, TDS, Ca²⁺, Mg²⁺, in ground water was investigated in rural area, Khorasan-e-Razavi province, Iran.
- Water distribution networks of many rural areas, requires attention to achieve the Iran quality standards of drinking water.
- Take the necessary actions in cases where water tends to be corrosive in the distribution network is necessary.
1. Data

Data presented here deal with monitoring of physical and chemical including EC, TDS, TH, CaH, pH, Turbidity, Cl, NO₃⁻, SO₄²⁻, F, Na⁺, TDS, Ca and Mg As in Khorasan-e-Razavi province, Iran. Fig. 1 shows location of water sampling sites in Torbat-e-Heydariyeh. Table 2 shows average of physical and chemical parameters of drinking water, water resources in the rural area of Torbat-e-Heydarie in 2014, Table 3 shows comparison drinking water resources in the rural area of Torbat-e-Heydarie in 2014, Table 4 shows calculation of water stability indices at sampling temperature.

2. Experimental design, materials and methods

2.1. Study area description

Torbat-e-Heydarie is one of the cities of Khorasan-e-Razavi province with an area of 3900 square kilometers located on 152 km south of the Mashhad city. The city with a population of 267,604 people and an area of 62220 square kilometers, between the meridian of 58 degrees and 41 min to 60 degrees 7 min east longitude and circuits of 34 degrees and 59 min to 35 degrees 51 min north latitude and its height from sea level free is 1333 m. Torbat-e-Heydarie is bordered from north with cities of Nishabur, Mashhad, fariman, from the East with the cities of Torbat Jam, Tayabad and Khaaf, from the south with the cities of Roshtkhar and Mahvelat and from the West with the city of Kashmar.

Fig. 1. Location of water sampling sites in Torbat-e-Heydariyeh [1,2].
### Table 1
Indicators used in the study for distribution network from different rural of Torbat-e-Heydariyeh [1–5].

| Index                          | Equation                                                                 | Index value | Water condition                                                                 |
|--------------------------------|--------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------|
| Langelier Saturation Index     | LSI = pH-pHs                                                             | LSI > 0     | Super saturated, tend to precipitate CaCO₃                                        |
|                                |                                                                          | LSI = 0     | Saturated, CaCO₃ is in equilibrium                                               |
|                                |                                                                          | LSI < 0     | Under saturated, tend to dissolve solid CaCO₃                                    |
| Ryznar Stability Index         | RSI = pHs2-pH                                                             | RSI < 6     | Super saturated, tend to precipitate CaCO₃                                        |
|                                |                                                                          | 6 < RSI < 7 | Saturated, CaCO₃ is in equilibrium                                               |
|                                |                                                                          | RSI > 7     | Under saturated, tend to dissolve solid CaCO₃                                    |
| Puckorius Scaling Index        | PSI = 2 (pHeq)–pH                                                        | PSI < 6     | scaling is unlikely to occur                                                      |
|                                |                                                                          | PSI > 7     | likely to dissolve scale                                                         |
| Larson-Skold Index             | Ls = (Cl⁻ + SO₄²⁻)/(HCO₃⁻ + CO₃⁻)                                       | LS < 0.8    | Chloride and sulfate are unlikely to interfere with the formation of protecting film|
|                                |                                                                          | 0.8 < LS < 1.2 | Corrosion rates may be higher than expected                                       |
|                                |                                                                          | LS > 1.2    | High rates of localized corrosion may be expected                                 |
| Aggressiveness Index           | AI = pH + log([(alk)/(H)])                                               | AI > 12     | Non aggressive                                                                   |
|                                |                                                                          | 10 < AI < 12| Moderately aggressive                                                            |
|                                |                                                                          | AI < 10     | Very aggressive                                                                  |

### Table 2
Average of physical and chemical parameters of drinking water, water resources in the rural Area of Torbat Heydariyeh at 2014.

| Village            | EC (µMΩ/cm) | TDS mg/l | T.H mg/l | CaH mg/l | CaCO₃ mg/l | pH Turbidity | Cl⁻ mg/l | NO₃⁻ mg/l | SO₄²⁻ mg/l | F⁺ mg/l | Na⁺ mg/l | Ca²⁺ mg/l | Mg²⁺ mg/l |
|--------------------|-------------|-----------|----------|-----------|-------------|--------------|----------|-----------|------------|----------|-----------|-----------|-----------|
| Fath Abad          | 926         | 605       | 130      | 48        | 8.20        | 97          | 13       | 149       | 0.5        | 144      | 19        | 20        |
| Seyuki             | 5250        | 3281      | 700      | 272       | 7.10        | 109         | 6        | 551       | 0.67       | 869      | 109       | 103       |
| Senjed bour        | 848         | 530       | 130      | 96        | 7.90        | 153         | 8        | 23        | 0.22       | 124      | 38        | 8         |
| Sanobar            | 225         | 141       | 82       | 60        | 8.20        | 4           | 6        | 9         | 0.08       | 17       | 24        | 5         |
| Hesar              | 549         | 343       | 110      | 56        | 7.80        | 34          | 10       | 37        | 0.28       | 75       | 22        | 13        |
| Kashkak            | 1305        | 816       | 460      | 396       | 7.70        | 70          | 7        | 338       | 0.59       | 101      | 158       | 15        |
| Kameh Sofia        | 1406        | 879       | 364      | 224       | 7.80        | 214         | 11       | 128       | 0.22       | 173      | 90        | 34        |
| Kame Olia          | 1004        | 628       | 310      | 162       | 7.80        | 137         | 7        | 65        | 0.21       | 104      | 68        | 36        |
| Sorkhabad          | 1627        | 1017      | 368      | 236       | 7.50        | 160         | 17       | 213       | 0.54       | 218      | 94        | 32        |
| Khornshbar         | 1525        | 953       | 590      | 444       | 7.20        | 137         | 80       | 152       | 0.12       | 105      | 178       | 35        |
| Besk               | 908         | 568       | 324      | 232       | 7.50        | 24          | 30       | 76        | 0.39       | 80       | 93        | 22        |
| Fadiah             | 1070        | 669       | 296      | 184       | 7.80        | 81          | 14       | 82        | 0.43       | 123      | 74        | 27        |
| Rud Majan          | 1004        | 628       | 364      | 200       | 7.50        | 116         | 14       | 26        | 0.24       | 83       | 80        | 39        |
| Deh Paeen          | 1316        | 823       | 244      | 148       | 7.70        | 190         | 37       | 58        | 0.40       | 192      | 59        | 23        |
| Fahandar           | 1542        | 964       | 224      | 144       | 7.90        | 291         | 37       | 73        | 0.47       | 264      | 58        | 19        |
| Khorram            | 2730        | 1706      | 308      | 152       | 8.20        | 468         | 14       | 465       | 0.67       | 433      | 61        | 37        |
| Deh Menar          | 1242        | 776       | 104      | 36        | 8.40        | 111         | 16       | 246       | 0.67       | 215      | 14        | 16        |
| Abd Abad           | 1360        | 850       | 264      | 92        | 8.21        | 232         | 15       | 176       | 0.56       | 180      | 37        | 41        |
| Bors               | 1122        | 701       | 292      | 160       | 7.80        | 140         | 7        | 218       | 0.28       | 119      | 64        | 32        |
| Tajrud             | 1827        | 1142      | 180      | 100       | 8.10        | 250         | 7        | 316       | 0.51       | 320      | 40        | 19        |
| Houze Sorkh        | 2760        | 1725      | 212      | 120       | 7.80        | 576         | 27       | 213       | 0.59       | 490      | 48        | 22        |
| Seyuki             | 2300        | 1438      | 144      | 80        | 8.30        | 434         | 18       | 168       | 0.60       | 440      | 32        | 15        |
| Bouri Abad         | 2590        | 1619      | 120      | 76        | 8.10        | 517         | 22       | 294       | 0.87       | 489      | 30        | 11        |
| Kaj Derakhht       | 769         | 481       | 124      | 100       | 7.80        | 77          | 25       | 78        | 0.41       | 13       | 40        | 6         |
| Seyuki             | 2310        | 1444      | 152      | 84        | 8.07        | 454         | 18       | 194       | 0.66       | 411      | 34        | 16        |
| Haji Beygi         | 1654        | 1034      | 544      | 380       | 7.60        | 191         | 13       | 312       | 0.39       | 150      | 152       | 39        |
| Asadieh            | 878         | 549       | 100      | 40        | 8.40        | 98          | 14       | 100       | 0.27       | 148      | 16        | 14        |
| Shileh Goshad      | 524         | 328       | 172      | 84        | 8.30       | 27          | 13       | 68        | 0.25       | 48       | 34        | 21        |
| Asad Abad          | 1439        | 899       | 240      | 64        | 8.21       | 262         | 26       | 151       | 0.57       | 205      | 26        | 42        |
The city has four parts: the central part, Jolgerok, Kadkan and Bayag and also has 6 towns and 11 rural districts and 250 inhabited villages. There is no permanent major surface flow in the Torbat-e-Heydarie basin.

2.2. Materials and methods

In this cross-sectional study 188 samples from 47 water sources were taken, 18 parameters were evaluated according to the standard method, also in terms of Standard compliance were compared with Iran and EPA water standards [13–17]. Experiments conducted in two general categories of device experiments and Titration. Titration Experiment includes temporary and permanent hardness, magnesium, calcium and chlorides, Device Experiment consist of pH, Electrical conductivity, Turbidity, Fluorine, nitrate and sulfate [2,18–21]. Data were analyzed by using Excel software and

| Village        | EC (μMoh/cm) | TDS mg/l | CaH mg/l CaCO₃ | pH | Turbidity NTU | Cl (mg/l) | NO₃ (mg/l) | SO₄²⁻ (mg/l) | F⁺ | Na⁺ | Ca²⁺ | Mg²⁺ |
|----------------|--------------|----------|----------------|----|---------------|-----------|------------|--------------|----|-----|------|------|
| Heshmat Abad   | 1692         | 1058     | 284            | 120| 8.3 1.5       | 148       | 14         | 485          | 0.38| 235 | 48   | 39   |
| Sarhang        | 1010         | 631      | 168            | 60 | 8.3 0.30      | 149       | 20         | 144          | 0.29| 163 | 24   | 26   |
| Kal Qari       | 1299         | 812      | 456            | 48 | 8.2 0.20      | 155       | 23         | 173          | 0.19| 105 | 19   | 98   |
| Pish Akhor     | 2600         | 1625     | 326            | 84 | 8.1 0.75      | 389       | 6          | 482          | 0.72| 500 | 34   | 58   |
| Soltan Abad    | 1448         | 905      | 200            | 60 | 8.3 0.44      | 223       | 12         | 219          | 0.55| 230 | 24   | 34   |
| Asfiukh        | 1674         | 1046     | 232            | 120| 7.8 0.07      | 341       | 16         | 121          | 0.29| 260 | 48   | 27   |
| Robat          | 1412         | 883      | 236            | 92 | 8.1 0.90      | 258       | 26         | 199          | 0.19| 235 | 37   | 35   |

| Village        | EC (μMoh/cm) | TDS mg/l | CaH mg/l CaCO₃ | pH | Turbidity NTU | Cl (mg/l) | NO₃ (mg/l) | SO₄²⁻ (mg/l) | F⁺ | Na⁺ | Ca²⁺ | Mg²⁺ |
|----------------|--------------|----------|----------------|----|---------------|-----------|------------|--------------|----|-----|------|------|
| Miandasht      |              |          |                |    |               |           |            |              |    |     |      |      |
| Nasar          | 1865         | 1166     | 356            | 84 | 8             | 388       | 9          | 206          | 0.29| 265 | 34   | 65   |
| Mahmoud Abad   | 1196         | 748      | 184            | 40 | 8.1 1.4       | 127       | 12         | 137          | 0.28| 202 | 16   | 35   |
| Asad Abad      | 1613         | 1008     | 352            | 92 | 8             | 220       | 26         | 236          | 0.30| 232 | 37   | 62   |
| Pangi          | 604          | 378      | 152            | 60 | 8.1 0.36      | 33        | 6          | 100          | 0.30| 76  | 24   | 22   |
| Esfiz          | 711          | 444      | 128            | 108| 7.9 0.38      | 71        | 6          | 168          | 0.20| 104 | 43   | 5    |
| Razg           | 519          | 324      | 248            | 157| 8             | 9         | 4          | 36           | 0.16| 16  | 63   | 22   |
| Nasar          | 260          | 163      | 64             | 52 | 8.2 0.23      | 18        | 6          | 32           | 0.08| 28  | 21   | 3    |
| Derakht Senjed | 1477         | 923      | 72             | 24 | 8.3 0.21      | 16        | 7          | 188          | 0.43| 300 | 10   | 12   |
| Nouri          | 1624         | 1015     | 240            | 100| 8.3 0.18      | 104       | 18         | 487          | 0.60| 253 | 40   | 34   |
| Sarbala        | 1350         | 844      | 132            | 32 | 8.3 0.14      | 88        | 11         | 463          | 0.63| 237 | 13   | 24   |
| Nosrat Abad    | 1288         | 805      | 100            | 32 | 7.9 0.31      | 111       | 16         | 266          | 0.60| 238 | 13   | 16   |

| Parameter | Unit | Maximum allowable | Minimum desirable | %villages |
|-----------|------|-------------------|--------------------|-----------|
| PH        | Dimensionless | 6.5–9     | 6.5–8.5          | –         | %100     | – | 6.5–8.2 |
| TDS       | mg/l          | 1500      | 500              | %21       | %68     | %11 | 500     |
| Cl        | mg/l          | 400       | 250              | %15       | %74.5   | %10.5 | 250     |
| So₄       | mg/l          | 400       | 250              | %10       | %76.5   | %13.5 | 250     |
| No₃       | mg/l          | 50        | –                 | %98       | –       | %2   | 10      |
| Ca        | mg/l          | 400       | 300              | –         | %100    | – | –       |
| Mg        | mg/l          | 150       | 30                | %43       | %75    | –   | –       |
| Na        | mg/l          | 200       | 200              | %21       | %51    | %28  | –       |
| F         | mg/l          | 1.5       | 0.5              | %36       | %64    | – | 2       |
| T.H       | mg/l(CaCO₃)   | 500       | 200              | %3.5      | %30.5  | %66 | –       |
| Tur       | NTU           | 5         | Less than 1      | 17        | %83    | – | 1       |
| EC        | μMoh/cm       | 2000      | 1500             | %21       | %64    | %15 | –       |

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In this cross-sectional study 188 samples from 47 water sources were taken, 18 parameters were evaluated according to the standard method, also in terms of Standard compliance were compared with Iran and EPA water standards [13–17]. Experiments conducted in two general categories of device experiments and Titration. Titration Experiment includes temporary and permanent hardness, magnesium, calcium and chlorides, Device Experiment consist of pH, Electrical conductivity, Turbidity, Fluorine, nitrate and sulfate [2,18–21]. Data were analyzed by using Excel software and
descriptive statistics such as minimum, maximum, mean and standard deviation. Water stability statuses in rural area of Torbat-e-Heydarie were investigated by using Langelier Saturation, Ryznar Stability, Puchorius scale, Larson-Skold and Aggressive Index. All these parameters are listed summarized in Table 1.

Acknowledgments

The authors want to thank the Torbat Heydariyeh University of Medical Sciences for their comprehensive support for this study.

Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.06.062.

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