

# GROUNDWATER QUALITY ASSESSMENT FOR DRINKING PURPOSE IN BALTANA AREA OF ZIRAKPUR, PUNJAB AND SECTOR-19, PANCHKULA CITY, HARYANA, INDIA

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Groundwater, quality, drinking, Baltana, Zirakpur, Panchkula.

## Abstract

Water is important for survival of living beings on the Earth. Developmental activities have put pressure on the availability and quality of water resources especially on groundwater. The present study has been carried out in Baltana area of Zirakpur of Mohali district, Punjab and Sector-19 of Panchkula city, Harvana. Four groundwater samples have been collected in the month of June 2019 from different locations in the study area. Geo-coordinates of groundwater samples were noted using mobile GPS. Chemical analysis of groundwater samples were done using field water testing kit prepared by Tamilnadu Water Supply and Drainage Board, Chennai for ten chemical parameters-pH, hardness, chloride, fluoride, iron, ammonia, nitrite, nitrate, phosphate and residual chlorine. pH is 7,5 in all the four groundwater samples, hardness ranges from 150 mg/l to 350 mg/l, chloride ranges from 50 mg/l to 270mg/l, fluoride ranges from 0.5 mg/l to 1 mg/l, iron ranges from 0.3mg/l to 2 mg/l,ammonia ranges from 0 mg/l to 3 mg/l, nitrite ranges from 0.2 mg/l to 1 mg/l, nitrate ranges from 20 mg/l to 100 mg/l, phosphate ranges from 0.5 mg/l to 1 mg/l, residual chlorine ranges from 0 mg/l to 0.2 mg/l. Overall groundwater quality at all the four groundwater sample locations i.e. Tribune Colony, Baltana (non-potable iron and ammonia), Saini Vihar, Baltana (nonpotable nitrate), Vaishali Enclave, Baltana (non-potable iron), Sector-19, Panchkula (non-potable iron and nitrate) is non-potable. The data of the study can be used for monitoring groundwater quality for drinking purpose in the study area.

# INTRODUCTION

Water is important for survival of all the living beings on the Earth. The present developmental activities have put stress on water quantity and quality. Though water quantity and quality play vital role in the existence of living beings and infrastructure but the role of good quality water is more than quantity of water. In urban areas groundwater is deteriorated due to anthropogenic pollution sources like household sewage waste and industrial waste disposals. Prakash and Somashekar (2006), Deshpande and Aher (2012), Rao et al. (2013), Alhaba by et al. (2015), Annapoorna and Janardhana (2015), Spanos et al. (2015), Srinivas et al. (2015), Madhav et al. (2018), Siddiqui et al. (2018), Hanumantharao, et al. (2019) have studied groundwater quality in urban areas.

## **STUDYAREA**

The study area Baltana is a part of Zirakpur in Mohali district, Punjab and Sector-19 of Panchkula city in Haryana. Baltana is located at a distance of 2.7 kms from Chandigarh connected by the Zirakpur Panchkula-Kalka highway NH-5. The study area is falling between the latitude30°40'50.62"N to 30°40'6.91"N and longitude76°49'18.18"E to 76.50'5.61"Eand covers an area of 9.649Km<sup>2</sup> (Fig 1). Baltana has changed from agriculture sector to residential and industrial sectors.

## **OBJECTIVE**

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

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## MATERIALS USED AND METHODOLOGY

In the study area four groundwater samples were collected during field visit in the month of June 2019 from tube wells in plastic 250 ml bottles. Geo-coordinates of the sample locations were noted using mobile GPS (Table 1). Chemical analysis of groundwater samples was done using Field Water Testing kit prepared by Tamilnadu Water Supply and Drainage Board (TAWD), Chennai for ten chemical parameters viz. pH, hardness, chloride, fluoride, iron, ammonia, nitrite, nitrate, phosphate and residual chlorine (Table 2). Results of groundwater samples analysis were categorized as desirable, permissible and non-potable on the basis of BIS (IS: 10500:2012) drinking water standards (Table 3).



Fig.1: Location map of the study area.

Table 1: Groundwater sample locations in the Study Area.

| S. No. | Sample Location           | Source    | Latitude   | Longitude  |  |
|--------|---------------------------|-----------|------------|------------|--|
| 1      | Vaishali Enclave, Baltana | Tube Well | 30.6796450 | 76.8245980 |  |
| 2      | SainiVihar, Baltana       | Tube Well | 30.6782630 | 76.8278850 |  |
| 3      | Sector 19, Panchkula      | Tube Well | 30.6713780 | 76.8321880 |  |
| 4      | Tribune Colony, Baltana   | Tube Well | 30.6716930 | 76.8259920 |  |

## Table 2: Results of groundwater samples analysis.

| S.<br>No. | Location                        | рН  | Hardness<br>(mg/l) | Chloride<br>(mg/l) | Fluoride<br>(mg/l) | Iron<br>(mg/l) | Ammonia<br>(mg/l) | Nitrite<br>(mg/l) | Nitrate<br>(mg/l) | Phosphate<br>(mg/l) | Residual<br>Chlorine<br>(mg/l) |
|-----------|---------------------------------|-----|--------------------|--------------------|--------------------|----------------|-------------------|-------------------|-------------------|---------------------|--------------------------------|
| 1.        | Tribune<br>Colony, Baltan       | 7.5 | 320                | 160                | 1                  | 2              | 3                 | 0.2               | 45                | 1                   | 0                              |
| 2.        | Saini Vihar,<br>Baltana         | 7.5 | 200                | 50                 | 1                  | 0.3            | 0.5               | 0.2               | 100               | 0.5                 | 0.2                            |
| 3.        | Vaishali<br>Enclave,<br>Baltana | 7.5 | 300                | 270                | 1                  | 2              | 0                 | 0.2               | 20                | 0.5                 | 0                              |
| 4.        | Sector-19,<br>Panchkula         | 7.5 | 150                | 50                 | 0.5                | 2              | 0.5               | 1                 | 100               | 0.5                 | 0.2                            |

# Table 3: BIS Drinking Water Standards (IS 10500:2012).

| S. No. | Constituent              | Pota       | Non-Potable |              |
|--------|--------------------------|------------|-------------|--------------|
|        |                          | Desirable  | Permissible | •            |
| 1      | pH                       | 6.5 to 8.5 | -           | <6.5 to >8.5 |
| 2      | Total Hardness (mg/l)    | <200       | 200-600     | >600         |
| 3      | Chloride (mg/l)          | <250       | 250-1000    | >1000        |
| 4      | Fluoride (mg/l)          | <1.0       | 1.0-1.5     | >1.5         |
| 5      | Iron (mg/l)              | <0.3       | -           | >0.3         |
| 6      | Ammonia (mg/l)           | <0.5       | -           | >0.5         |
| 7      | Nitrite (mg/l)           | <1.0       | -           | >1.0         |
| 8      | Nitrate (mg/l)           | <45        | -           | >45          |
| 9      | Phosphate (mg/l)         | <1.0       | -           | >1.0         |
| 10     | Residual Chlorine (mg/l) | <0.2       | 0.2-1       | >1.0         |

#### I.pH

In the study area, pH in all the four groundwater samples (Tribune Colony, Baltana, SainiVihar, Baltana, Vaishali Enclave, Baltana, Sector-19,Panchkula) is 7.5 which falls under desirable category of BIS (IS 10500:2012) drinking water standards (Fig.2).



Fig.2: pH in groundwater samples.

#### ii. Hardness

In the study area, hardness ranges from 150 mg/l to 350 mg/l. Hardness in groundwater samples at Saini Vihar, Baltana (200 mg/l) and Sector-19, Baltana (150mg/l) is desirable while permissible at Tribune Colony, Baltana (320 mg/l) and Vaishali Enclave, Baltana (300 mg/l) (Fig.3).



Fig. 3: Hardness in groundwater samples.

## iii. Chloride

In the study area, chloride ranges from 50 mg/l to 270mg/l. Chloride is desirable in groundwater samples at Tribune Colony, Baltana (160mg/l), Saini Vihar, Baltana (50mg/l), Sector-19,Panchkula (50mg/l) and permissible at Vaishali Enclave, Baltana (270 mg/l) (Fig.4).



Fig. 4: Chloride in groundwater samples.

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#### iv. Fluoride

In the study area, fluoride ranges from 0.5 mg/l to 1 mg/l. Fluoride is desirable in all the four groundwater samples-Tribune Colony, Baltana (1 mg/l), Saini Vihar, Baltana (1 mg/l),Vaishali Enclave, Baltana (1 mg/l),Sector-19, Panchkula (0.5 mg/l) (Fig.5).



Fig. 5: Fluoride in groundwater samples.

#### v. Iron

In the study area, iron ranges from 0.3 mg/l to 2 mg/l. Iron is desirable in groundwater sample at Saini Vihar, Baltana (0.3 mg/l) and non-potable at Tribune Colony, Baltana (2 mg/l), Vaishali Enclave, Baltana (2 mg/l), Sector-19, Panchkula (2 mg/l) (Fig.6).



Fig. 6: Iron in groundwater samples.

## vi. Ammonia

In the study area, ammonia ranges from 0 mg/l to 3 mg/l. Ammonia is desirable in groundwater samples at Saini Vihar, Baltana (0.5 mg/l), Vaishali Enclave, Baltana (0 mg/l), Sector-19, Baltana (0.5 mg/l) and non-potable at Tribune Colony, Baltana (3 mg/l) (Fig.7).



Fig.7: Ammonia in groundwater samples.

#### vii. Nitrite

In the study area, nitrite ranges from 0.2 mg/l to 1 mg/l. Nitrite is desirable in all the four groundwater samples (Tribune Colony, Baltana (0.2 mg/l), Saini Vihar, Baltana (0.2 mg/l), Vaishali Enclave, Baltana (0.2 mg/l), Sector-19,Baltana (1 mg/l) (Fig.8).



Fig. 8: Nitrite in groundwater samples.

#### viii. Nitrate

Nitrate ranges from 20 mg/l to 100 mg/l in the study area. Nitrate is desirable in groundwater samples at Tribune Colony, Baltana (45 mg/l) and Vaishali Enclave, Baltana (20 mg/l) and non-potable at Saini Vihar, Baltana (100 mg/l) and Sector-19, Panchkula (100 mg/l) (Fig.9).



Fig. 9: Nitrate in groundwater samples.

## ix. Phosphate

In the study area, phosphate ranges from 0.5 mg/l to 1 mg/l. Phosphate is desirable for drinking purpose in all the four groundwater samples (Tribune Colony, Baltana (1 mg/l), Saini Vihar, Baltana (0.5 mg/l), Vaishali Enclave, Baltana (0.5 mg/l) and Sector-19,Baltana (0.5 mg/l) (Fig.10).



Fig. 10: Phosphate in groundwater samples.

#### x. Residual Chlorine

In the study area, residual chlorine ranges from 0 mg/l to 0.2 mg/l. In all the four groundwater samples residual chlorine is desirable as per BIS (IS 10500:2012) drinking water standards (Tribune Colony, Baltana 0 mg/l, Saini Vihar, Baltana 0.2 mg/l, Vaishali Enclave, Baltana 0 mg/l, Sector-19, Baltana 0.2 mg/l) (11).



Fig. 11: Residual Chlorine in groundwater samples.

## **GROUNDWATER QUALITY AT SAMPLE SITES**

#### i. Tribune Colony, Baltana

Tribune Colony, Baltana groundwater sample have pH, chloride, fluoride, nitrite, nitrate, phosphate, residual chlorine are desirable; hardness is permissible; iron, ammonia are non-potable, hence, groundwater is non-potable (Fig.12).



Fig.12: Groundwater quality at Tribune Colony, Baltana.

## ii. Saini Vihar, Baltana

Saini Vihar, Baltana groundwater sample have pH, hardness, chloride, fluoride, iron, ammonia, nitrite, phosphate, residual chlorine are desirable and nitrate is non-potable, hence, groundwater is non-potable (13).



Fig. 12: Groundwater quality at Tribune Colony, Baltana.

#### iii. Vaishali Enclave, Baltana

Vaishali Enclave, Baltana groundwater sample have pH, fluoride, ammonia, nitrite, nitrate, phosphate, residual chlorine are desirable; hardness, chloride are permissible and iron is non-potable, hence, groundwater is non-potable (Fig.14).



Fig. 14: Groundwater quality at Vaishali Enclave, Baltana.

# iv. Sector-19, Panchkula

Sector-19, Panchkula groundwater sample have pH, hardness, chloride, fluoride, ammonia, nitrite, phosphate, residual chlorine are desirable and iron, nitrate are non-potable, hence, groundwater is non-potable (Fig.15).



Fig. 15: Groundwater quality at Sector-19, Panchkula.

## CONCLUSIONS

In the study area pH, fluoride, nitrite, phosphate, residual chlorine are desirable in all the four groundwater samples. Hardness is desirable at SainiVihar (200 mg/l) and Sector-19 (150 mg/l) while permissible at Tribune Colony (320 mg/l) and Vaishali Enclave (300 mg/l). Chloride is desirable at Tribune Colony (160 mg/l), SainiVihar (50 mg/l), Sector-19 (50 mg/l) and permissible at Vaishali Enclave (270 mg/l). Iron is desirable at Saini Vihar (0.3 mg/l) and non-potable at Tribune Colony (2 mg/l), Vaishali Enclave (2 mg/l), Sector-19 (2 mg/l). Ammonia is desirable at Saini Vihar (0.5mg/l), Vaishali Enclave (0 mg/l), Sector-19 (0.5 mg/l) and nonpotable at Tribune Colony (3 mg/l). Nitrate is desirable at Tribune Colony (45 mg/l) and Vaishali Enclave (20 mg/l) and non-potable at Saini Vihar (100 mg/l) and Sector-19 (100 mg/l). Groundwater quality at all the four groundwater sample locations i.e. Tribune Colony, Baltana (non-potable

iron and ammonia), Saini Vihar, Baltana (non-potable nitrate), Vaishali Enclave, Baltana (non-potable iron), Sector-19, Panchkula (non-potable iron and nitrate) is non-potable. The study is highly useful for monitoring groundwater quality for drinking purpose in the study area.

## REFERENCES

**Alhababy, Adel M. and Al-Rajab, Abdul Jabbar** (2015): Groundwater quality assessment in Jazan region, Saudi Arabia, *Current World Environment*, **10** (1):22-28.

**Annapoorna, H. and Janardhana, M.R.** (2015): Assessment of groundwater quality for drinking purpose in rural areas surrounding a defunct copper mine, International conference on water resources, coastal and ocean engineering (ICWRCOE 2015), *Aquatic Procedia*, **4**:685-692.

**Deshpande,S.M. and Aher,K.R.** (2012): Evaluation of groundwater quality and its suitability for drinking and agriculture use in parts of Vaijapur, District Aurangabad, MS, India, *Research Journal of Chemical Sciences*, **2**(1):25-31.

Hanumantharao, C. and Koteswararao, M. and Kalyan, T. (2019): Groundwater quality assessment for drinking purpose in Vijayawada region, Andhra Pradesh, India, *International Journal of Engineering and Advanced Technology*, **8** (5):2147-2152.

Madhav, Sughosh, Ahamad, Arif, Kumar, Ashutosh, Kushawaha, Jyoti, Singh, Pardeep and Mishra, P.K. (2018): Geochemical assessment of groundwater quality for its suitability for drinking and irrigation purpose in rural areas of Sant Ravidas Nagar (Bhadohi), Uttar Pradesh, Geology. *Ecology and Landscapes*. 2(2):127-136.

**Prakash, K.L. and Somashekar, R.K.** (2006): Groundwater quality-assessment on Anekaltaluk, Bangalore Urban district, India. *Journal of Environmental Biology*. **27** (4):633-637.

**Rao, G. Tamma, GurunadhaRao, V.V.S. and Ranganathan, K.** (2013): Hydrogeochemistry and groundwater quality assessment of Ranipet Industrial Area, Tamil Nadu, India, *J.EarthSyst.Sci.*, **122** (3):855-867.

**Spanos, Thomas, Ene, Antoaneta, Xatzixristou, Christina, Agelos Papaioannou** (2015): Assessment of groundwater quality and hydrogeological profile of Kavala area, Northern Greece, *Rom. Journ. Phys.*, **60** (7-8):1139-1150.

**Srinivas,R., Bhakar, Prashant, and Singh, Ajay Pratap** (2015): Groundwater quality assessment in some selected area of Rajasthan, India using Fuzzy Multi-Criteria Decision Making Tool, International conference on water resources, coastal and ocean engineering (ICWRCOE 2015), *Aquatic Procedia*, **4**:1023-1030.

Siddiqui Absar, Kulkarni, Deepali, Sohoni, V.S. and Thorat, S.S. (2018): Analysis of groundwater quality in Pune City, International Journal of Civil Engineering and Technology, 9 (6):1088-1095.