# Physico-Chemical Analysis of Underground Drinking Water of Rural-Urban Areas: A Case Study of Jind Block, Jind District, Haryana, India.

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**ABSTRACT:**

According to Indian philosophy nature is made up of panch mahatatvas; Agni, Jal, Prithvi, Vayu,Aakash.Jal/Water is a natural resource for all living organisms, plants as well as animals. Social, economical, political and geographical development based on availability of fresh water. Under the pressure of urbanization and industrialisation the quality of water also degraded by over and exhaustive use without proper management. It is essential to analyse the water quality parameters for its use in domestic, agriculture,industrial and in other sectors. Purity and security of water is indispensable for the worldwide population.Keeping in mind the development and natural environmental conservation to study the various quality parameters of underground water in urban-rural areas of Jind block, district Jind,Haryana is the main focus of water quality analysis research work. A total of 23 samples were assembled from the different sampling sites in well treated sample bottles and immediately preserved for analytical procedure for different parameters like electrical conductance EC, pH, total hardness TH, total alkalinity TA, carbonate, bicarbonate, total dissolved solid TDS, calcium, magnesium, sodium,potassium, nitrate, phosphate sulphate, chloride, iron and turbidity. All parameter values were compared with the prescribed limit of WHO, Indian Council of Medical Research (ICMR) and Bureau of Indian standard (BIS) for drinking water quality parameters. It has evaluated that the supply water quality in different localities of Jind block is of low medium,and can be used for domestic and other purposes after proper treatment. To improve the quality of water every suggestion has been given to the concerned authorities.

**KEYWORDS:** Physico- chemical, groundwater, parameters, pH, TDS, EC**, TH.**

## 1. Introduction

For human welfare water quality is an important factor. Taste, smell, color are generally observed physical properties of water. Evaluation of specified physical, chemical and biological properties of water is essential to life and harmonious development of our bodies. So naturally water is the mother and medium for living beings on earth. It is used for drinking, sanitation, agriculture, industrial and various other means according to the needs of humans. Social, ritual, lifestyle and economic development are all based on pure fresh water availability. Approximately two thirds of water covers the Earth surface. Only 2.5% of earth water is available for all living beings on earth and the rest of the 97.5% is in the oceans. It has been observed that 13% of this amount is groundwater, which is the major source for the worldwide population (Bindu & Shelvemohan: 2009).

Actually, increase in population, modernisation and rapid increase in industrialization and urbanisation, extensive use of water severely damaged the water ecosystem. Polluted water, air and soil have created a serious threat to the environment. Polluted water is a hazard for life. Major sources of water pollution are: industrial,domestic, medicinal wastes and other waste materials directly discharged into natural water bodies. Major pollutants such as synthetic chemicals , herbicides, pesticides, hazardous polychlorinated bi phenyl and fertilizer also approach the water supply. The epidemic and chronic disease in human beings are caused by the polluted groundwater. It has been observed that cardiovascular disease and water composition are correlated to each other. Due to fluorosis this order in teeth and bone is found in chloride rich water. Micro biological activity on organic matter may also produce carbonates and bicarbonates . These alkaline matters are a big problem for the industrial sector because alkaline water used in boilers for steam generation may cause precipitation of sludge and deposition of scale, producing caustic imbrittlement. Domestic waste is discharged into the pits and ponds from which waste material percolates down to the water table. Sometimes there is a possibility of dissolution of rocky material in the area. Surface water has been used for domestic and agriculture purposes since ancient times. In Haryana above 50% of the net population completes its daily requirement from groundwater. In rural areas tubewell, hand pumps & wells are the main source of groundwater. Due to the limited capacity of the water supply, compel the rural and urban population for domestic, agriculture and other uses of surface water. Irrigation plays an important role in the economy of any area state and Nation like Haryana & India. Various researchers have analysed groundwater samples to find the solution of high fluoride concentration, high cation and anion concentration along with high TDS which becomes one of the most important toxicological and Geo environment issues in India.

**2. Study Area and Sampling**

Jind District is located in the Haryana state of India between 29.03 and 29.51 latitude and 75.53 to 76.43. It is located on the bank of the Hasi branch of the Western Yamuna canal. The entire water supply rural and urban area is based on ground water from the handpump, tubewell and canals. The main aim of study is to analyse the various parameters of water quality.

In the post-monsoon time of September- October 2017, 23 samples were collected from different locations of rural and urban areas of Jind block. Water samples were collected in pre-treated and labelled sample bottles (2.5L)from different sites like- temples, schools, railway stations, specified chauk etc. The sample bottles were washed with 2% nitric acid and ringed three times by double distilled water before sampling and with water of the sample at the sites using standard protocol given in (APHA 1992). Samples were preserved and carried in the laboratory for analysis. Sample sites were named as station J-1 to J-23. Location of sample sites are given in Table-1.

**3. Material and Method**

The physico-chemical analysis of water samples were carried out for various characteristic parameters such as: electrical conductance, total desert solid (TDS), pH, total hardness (TH), total alkalinity (TA), sodium (Na+), potassium (K+), calcium(Ca2+), magnesium(Mg2+) iron(Fe3+) carbonate(CO3'), bi- carbonate(HCO3''),chloride(Cl'), sulphate (SO4'') fluoride(F') nitrate (NO3')and phosphate (PO4''') as per standard procedure described by the Standard Method for Examination of Water and West water American Public Health Association. The pH,EC,TDS, and salinity of all water samples were analysed using the digital pH and electrical conductometers. Calcium and magnesium along with total hardness (TH) is determined with the EDTA titration method, chloride by Argento metric titration and TA was determined by titration method with sulphuric acid. Fluoride analysed by portable kit method.

**4. Results and Discussion**

The experimental results of all water characteristics are listed in Table-3. The results of Table-3 are correlated with the standard parameters values of WHO, ICMR and BIS of Table-2.

## Table-1: Sample Sites, Source, Code and Depth (Feet).

| Sr. No. | Sample Site | Source | Code | Depth |
|---|---|---|---|---|
| 1 | Igrah | Submersible | J-1 | 65 |
| 2 | Ikash | Submersible | J-2 | 70 |
| 3 | Intal Kalan | Submersible | J-3 | 150 |
| 4 | Intal Khurd | Handpump | J-4 | 48 |
| 5 | Jajwan | Submersible | J-5 | 80 |
| 6 | Jalapura Kalan | Submersible | J-6 | 120 |
| 7 | Jalal Pura Khurd | Handpump | J-7 | 180 |
| 8 | Jhanj Kalan | Submersible | J-8 | 85 |
| 9 | Jhanj Khurd | Handpump | J-9 | 98 |
| 10 | Railway Station | Handpump | J-10 | 50 |
| 11 | Jind Devilal Chowk | Submersible | J-11 | 120 |
| 12 | Jind Battak Chowk | Submersible | J-12 | 150 |
| 13 | Jitgarh | Submersible | J-13 | 35 |
| 14 | Julani | Handpump | J-14 | 350 |
| 15 | Kendila | Submersible | J-15 | 55 |
| 16 | Kerkheri | Handpump | J-16 | 120 |
| 17 | Khark Rangi | Submersible | J-17 | 70 |
| 18 | Khema Kheri | Handpump | J-18 | 50 |
| 19 | Kheri Taloda | Handpump | J-19 | 20 |
| 20 | Khokhri | Handpump | J-20 | 50 |
| 21 | Kinana | Handpump | J-21 | 56 |
| 22 | Kishanpura | Submersible | J-22 | 150 |
| 23 | Lalitkhera | Handpump | J-23 | 20 |

**Table-2: Analytic Methods, BIS, ICMR, & WHO Parameters for Drinking Water.**

| S. No. | Parameter | Method employed | BIS (IS 10500-91) Desirable limit | BIS (IS 10500-91) Maximum permissible limit | ICMR Desirable limit | ICMR Maximum permissible limit | WHO |
|---|---|---|---|---|---|---|---|
| 1 | pH | Digital pH meter | 6.5–8.5 | No relaxation | 7.0–8.5 | 6.5–9.2 | 6.5–8.5 |
| 2 | TDS (mg/L) | Digital TDS meter | 500 | 2000 | 500 | 1500–3000 | 1000 |
| 3 | TH (mg/L) | Titrimetric (EDTA) | 300 | 600 | 300 | 600 | 500 |
| 4 | $Ca^{2+}$ (mg/L) | Titrimetric (EDTA) | 75 | 200 | 75 | 200 | 200 |
| 5 | $Mg^{2+}$ (mg/L) | Titrimetric (EDTA) | 30 | 100 | 50 | – | 50 |
| 6 | $Cl^{-}$ (mg/L) | Titrimetric ($AgNO_3$) | 250 | 1000 | 200 | 1000 | 200 |
| 7 | Turbidity (mg/L) | Nephelometry | 1 | 5 | 1 | 5 | 5 |
| 8 | $SO_4^{2-}$ (mg/L) | Spectrometric method | 200 | 400 | 200 | 400 | 400 |
| 9 | $NO_3^{-}$ (mg/L) | Spectrometric method | 45 | 100 | 20 | 100 | 10 |
| 10 | $PO_4^{3-}$ (mg/L) | Spectrometric method | – | – | – | – | – |
| 11 | Na/K (mg/L) | Flame photometer | – | – | – | – | – |
| 12 | $Fe^{3+}$ (mg/L) | Spectrometric method | 0.3 | 1.0 | 0.1 | 1.0 | 1.0 |
| 13 | $F^{-}$ (mg/L) | APHA method | 1.0 | 1.5 | 1 | 1.5 | 1.5 |
| 14 | As (mg/L) | APHA method | 0.0 | 0.05 | 0.0 | 0.05 | 0.05 |

**Table-3: Experimental Data**

| Sr. No. | Sample code | pH | E.C. | T.D.S. | T.H. | $Ca^{2+}$ | $Mg^{2+}$ | T.A. | $Cl^{--}$ | $F^{--}$ | Na+ | $K^{+}$ | $SO_4^{2+}$ | $PO_4^{3--}$ | $NO_3^{--}$ | $Fe^{3+}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | J-1 | 7.81 | 1.708 | 1098 | 595 | 160 | 35 | 390 | 130 | 2.5 | 145 | 3.8 | 129 | 7.04 | 6.8 | 0.22 |
| 2 | J-2 | 7.79 | 0.6 | 374 | 215 | 44 | 26 | 150 | 39 | 1.0 | 56 | 3.5 | 65 | 2.15 | 5.3 | 0.29 |
| 3 | J-3 | 7.81 | 1.56 | 1009 | 665 | 127 | 84 | 385 | 178 | 2.0 | 263 | 8.5 | 199 | 2.29 | 5.2 | 0.19 |

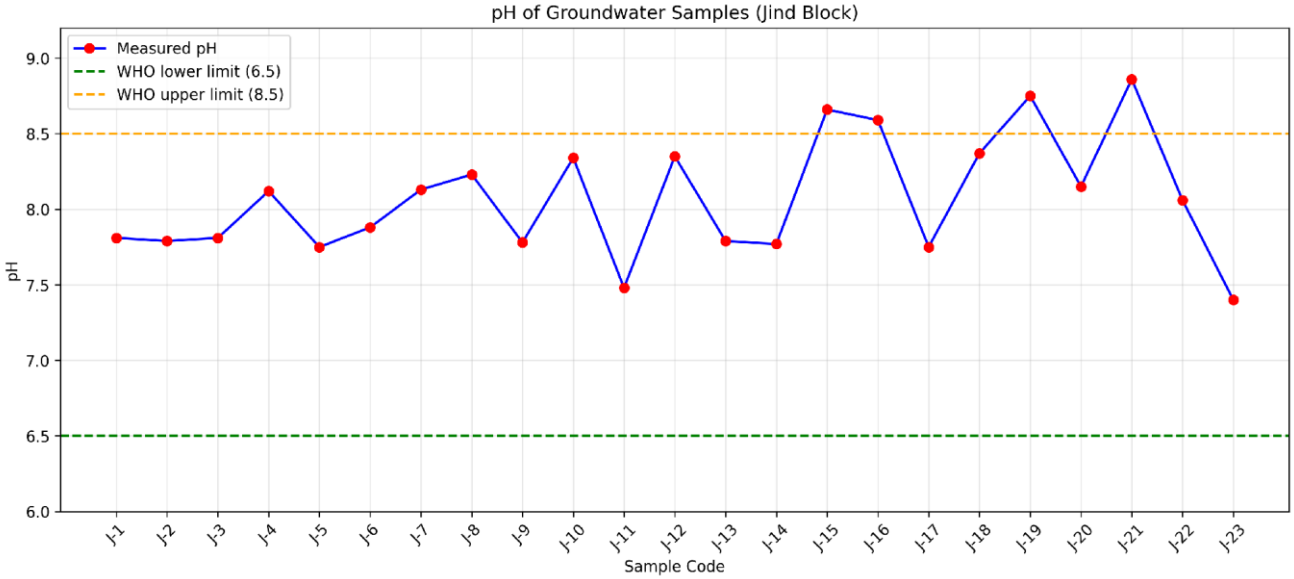
| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | J-4 | 8.12 | 3.12 | 2198 | 960 | 180 | 194 | 495 | 756 | 3.5 | 215 | 12.4 | 367 | 2.37 | 8.3 | 0.17 |
| 5 | J-5 | 7.75 | 2.08 | 1321 | 245 | 48 | 36 | 480 | 448 | 1.5 | 197 | 8.9 | 225 | 0.97 | 2.7 | 0.56 |
| 6 | J-6 | 7.88 | 1.378 | 868 | 270 | 54 | 33 | 555 | 249 | 3.8 | 485 | 8.2 | 115 | 2.64 | 50.8 | 0.64 |
| 7 | J-7 | 8.13 | 0.525 | 358 | 315 | 68 | 35 | 385 | 55 | 1.0 | 44 | 8.5 | 33 | 4.18 | 52.8 | 0.83 |
| 8 | J-8 | 8.23 | 0.37 | 242 | 150 | 30 | 18 | 215 | 35 | 2.5 | 45 | 2.0 | 44 | 0.4 | 23.9 | 0.24 |
| 9 | J-9 | 7.78 | 1.869 | 1174 | 790 | 158 | 76 | 560 | 395 | 0.5 | 110 | 17.2 | 199 | 0.48 | 5.7 | 0.34 |
| 10 | J-10 | 8.34 | 0.685 | 440 | 285 | 80 | 56 | 370 | 150 | 0.7 | 250 | 9.3 | 80 | 1.40 | 7.2 | 0.31 |
| 11 | J-11 | 7.48 | 1.998 | 1275 | 890 | 157 | 120 | 950 | 275 | 0.5 | 194 | 42.4 | 128 | 0.58 | 72.8 | 0.23 |
| 12 | J-12 | 8.35 | 0.695 | 415 | 245 | 80 | 23 | 255 | 90 | 1.2 | 23 | 11 | 88 | 2.68 | 35.7 | 0.45 |
| 13 | J-13 | 7.79 | 1.568 | 788 | 415 | 85 | 49 | 480 | 180 | 1.0 | 240 | 12 | 108 | 1.04 | 8.8 | 0.11 |
| 14 | J-14 | 7.77 | 3.06 | 1940 | 635 | 110 | 87 | 620 | 485 | 1.5 | 320 | 32 | 325 | 5.55 | 10.8 | 0.31 |
| 15 | J-15 | 8.66 | 1.210 | 775 | 210 | 46 | 22 | 385 | 115 | 4.0 | 175 | 6.4 | 112 | 0.78 | 82.4 | 0.11 |
| 16 | J-16 | 8.59 | 0.720 | 495 | 400 | 80 | 47 | 260 | 100 | 0.5 | 140 | 9.8 | 27 | 1.04 | 14.3 | 0.21 |
| 17 | J-17 | 7.75 | 0.724 | 496 | 420 | 72 | 46 | 365 | 135 | 2.5 | 266 | 3.8 | 297 | 1.72 | 1.9 | 0.24 |
| 18 | J-18 | 8.37 | 0.668 | 468 | 200 | 48 | 19 | 270 | 84 | 1.5 | 84 | 1.8 | 135 | 1.66 | 12.2 | 0.31 |
| 19 | J-19 | 8.75 | 0.604 | 415 | 360 | 82 | 35 | 305 | 58 | 2.5 | 175 | 5.6 | 37 | 2.39 | 1.9 | 0.21 |
| 20 | J-20 | 8.15 | 1.680 | 1074 | 300 | 68 | 32 | 560 | 185 | 4.0 | 115 | 6.0 | 282 | 1.17 | 3.4 | 0.17 |
| 21 | J-21 | 8.86 | 1.028 | 658 | 530 | 96 | 70 | 440 | 115 | 5.0 | 164 | 8.4 | 165 | 2.4 | 12.0 | 0.29 |
| 22 | J-22 | 8.06 | 3.27 | 1965 | 1060 | 200 | 136 | 410 | 576 | 2.5 | 328 | 8.8 | 465 | 1.20 | 0.8 | 0.23 |
| 23 | J-23 | 7.4 | 1.08 | 688 | 312 | 76 | 29 | 260 | 115 | 1.0 | 189 | 15.9 | 60 | 2.46 | 2.8 | 0.31 |

The experimental results of physico- chemical analysis water samples of rural and urban areas of Jind block, district Jind, Haryana India are listed in Table- 2. The experimental result compared with Table-3, the standard recommended limits of WHO,Indian Council of Medical Research ICMR. The wide deviations were observed in water quality parameters from the prescribed standard limits.

### 4.1. pH

The accessible range for drinking water is 7.0-8.5. The limit of pH of water in domestic and other use is 6.5 to 9.2 acceptable in the absence of another source of water. The pH value ranges 7.4 to 8.86 with the average value of pH is 8.079. The experimental results of groundwater samples show a slightly alkaline nature.

**Figure-1: pH of Groundwater Samples (Jind Block).**




(Measured pH values are shown with red dots. WHO reference lines: lower limit 6.5 and upper limit 8.5.)

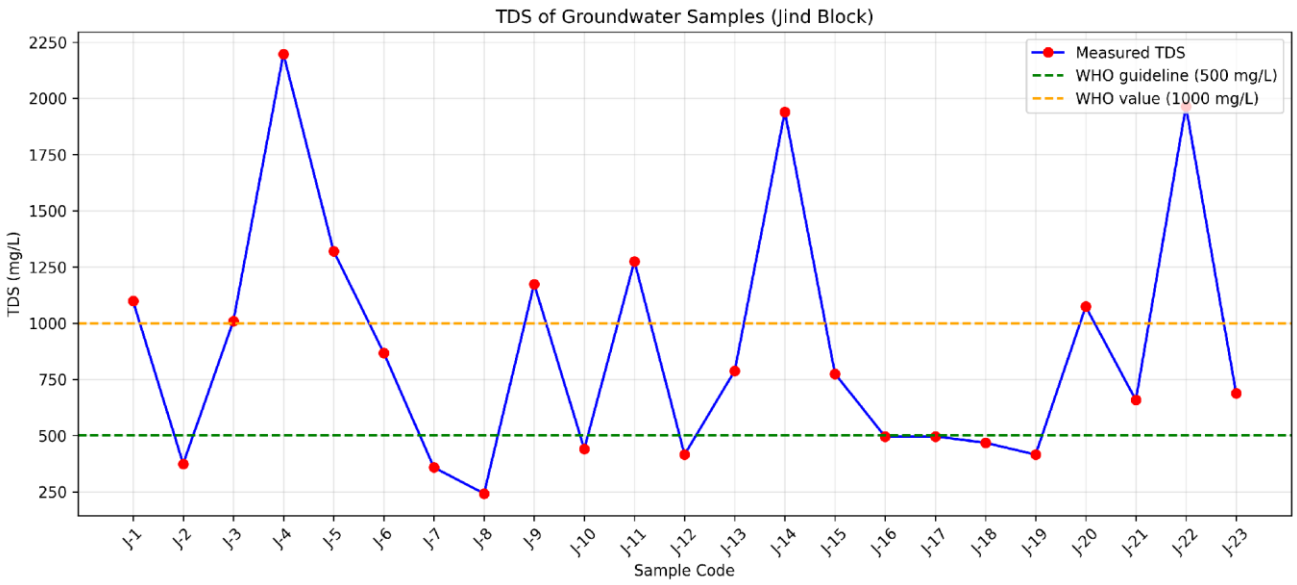
### 4.2 Electrical Conductivity

The electrical conductance range of groundwater samples are in range 0.37 to 3.27dS with a mean value 1.369 dS. Electrical conductance is a good means to find the quality of water purity.

### 4.3. Total Dissolved Solid

The TDS of water samples are in the range of 242 to 2198 mg/L with average 903.354 mg/L. The maximum acceptable concentration of TDS in groundwater for domestic purposes is 500 mg per litre (WHO). The excessive permissible range is 1500 mg/L. A total of 14 samples are non-saline and 9 samples are slightly saline in nature.

**Figure-2:TDS of Groundwater Samples (Jind Block).**

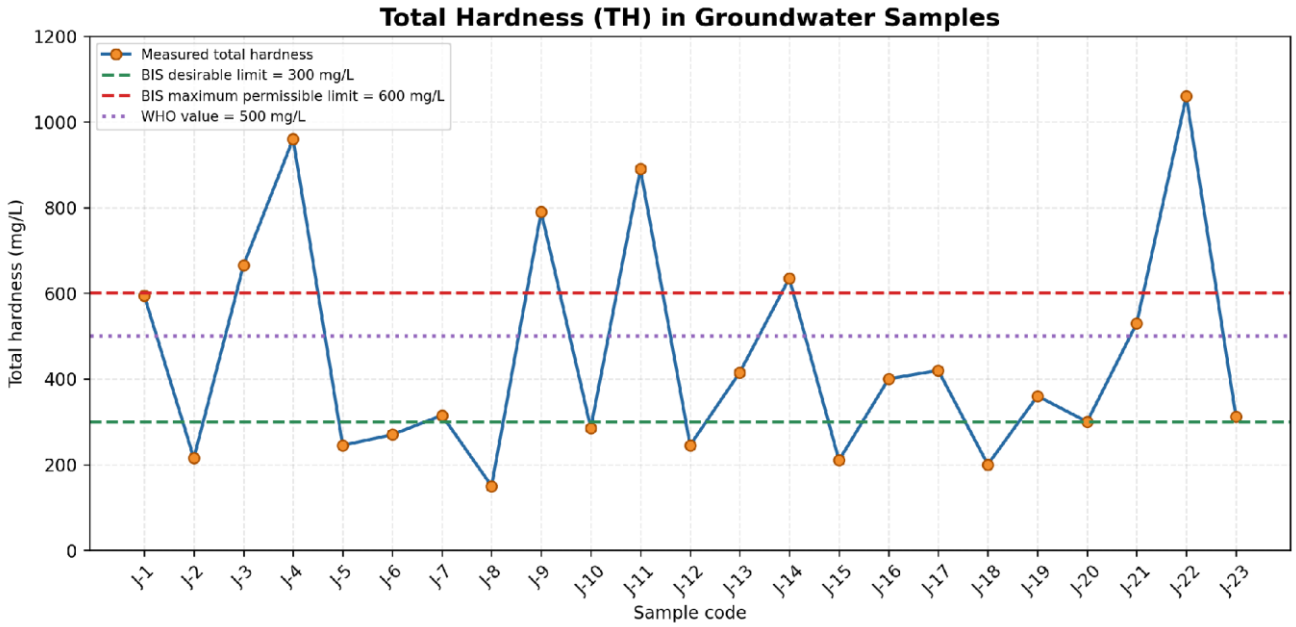



(Measured TDS values are shown with red dots. Reference lines are shown at 500 mg/L and 1000 mg/L.)

### 4.4. Total Hardness Calcium and Magnesium

TH is an important parameter for water in domestic use. Total hardness is the sum of concentration of Calcium and Magnesium. The total hardness range in study area 150 to1060 mg/L with average value of 457.260 mg/L. The permissible range of calcium and magnesium in groundwater for domestic purposes are 50 and 200 mg/ L(WHO) respectively. The range of calcium is 30 to 200 mg/K with mean value 95.179mg/L. The Magnesium concentration is in the range of 18 to 136 mg/ L with mean value 54.43 mg/L.

**Figure-3: Total Hardness (TH) Graph**

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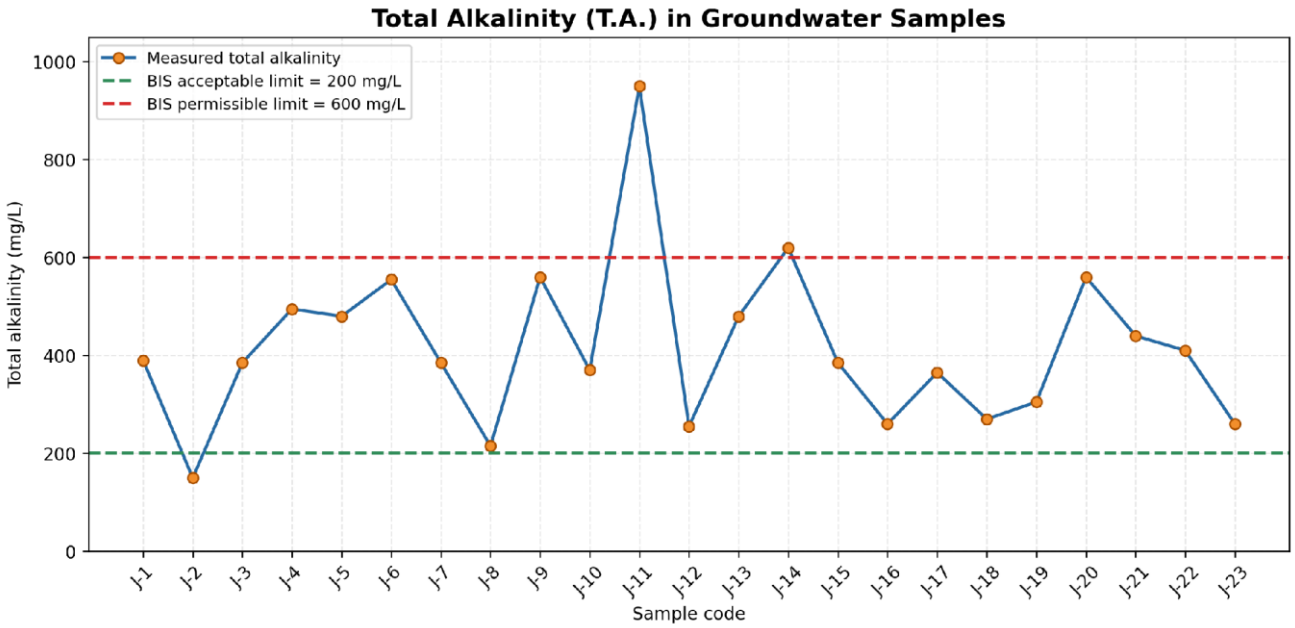
(Groundwater Samples of Jind Block,J-1 to J-23).

### 4.5. Total Alkalinity

Total alkalinity in water samples is in the limit of 150 to 950 mg/L with average value of 415 mg/L. According to the WHO, the recommended value of total alkalinity is 200 mg/L. The high value of total alkalinity is due to bicarbonate & sulphate in water solution.

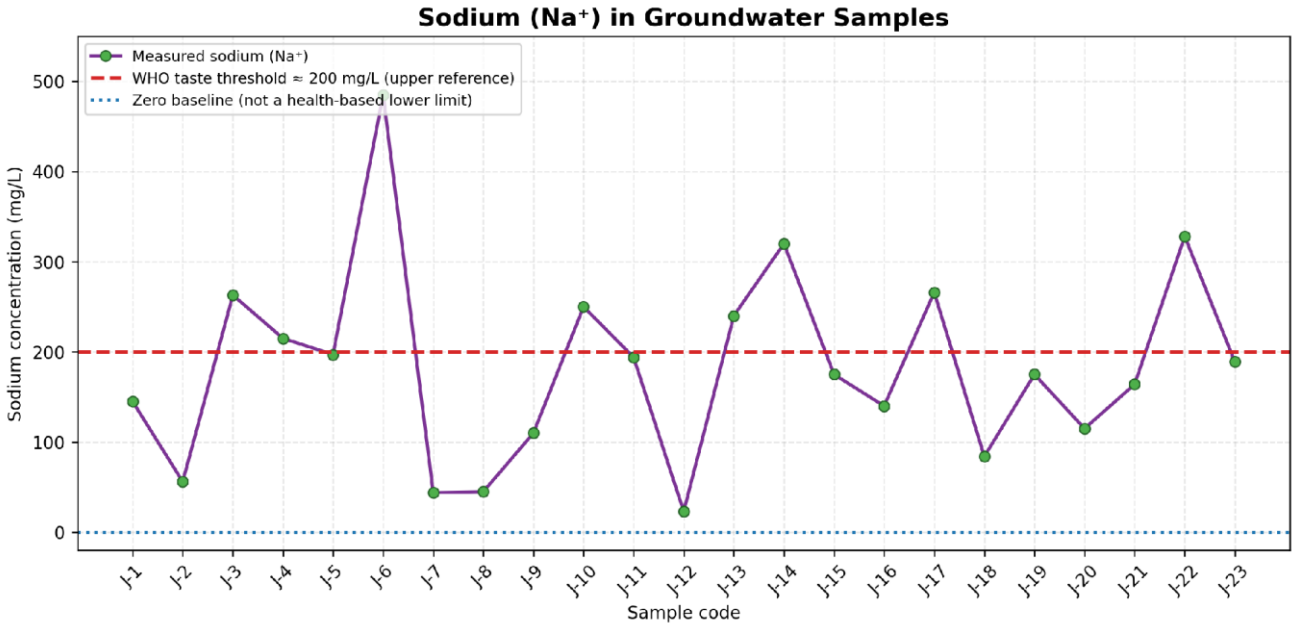
**Figure-4: Total Alkalinity(TA) of GroundWater Samples.**




(Groundwater Samples of Jind Block, J-1 to J-23)

### 4.6. Sodium and Potassium

The concentration of Sodium ions in the water sample ranges 23 to 485 mg/L with average value 184.913 mg/L. Sample J-6 has the highest value of sodium 485mg/L+WHO limit of 200 mg/L ).The concentration of Sodium is more than 50 mg/L makes the water unusual for domestic use and causes serious health problems. The content of potassium ion in the present case ranges in 2 to 42.4 mg/L with average value 10.704 mg/L.**Figure-5: Sodium($Na^+$) in Groundwater Samples.**

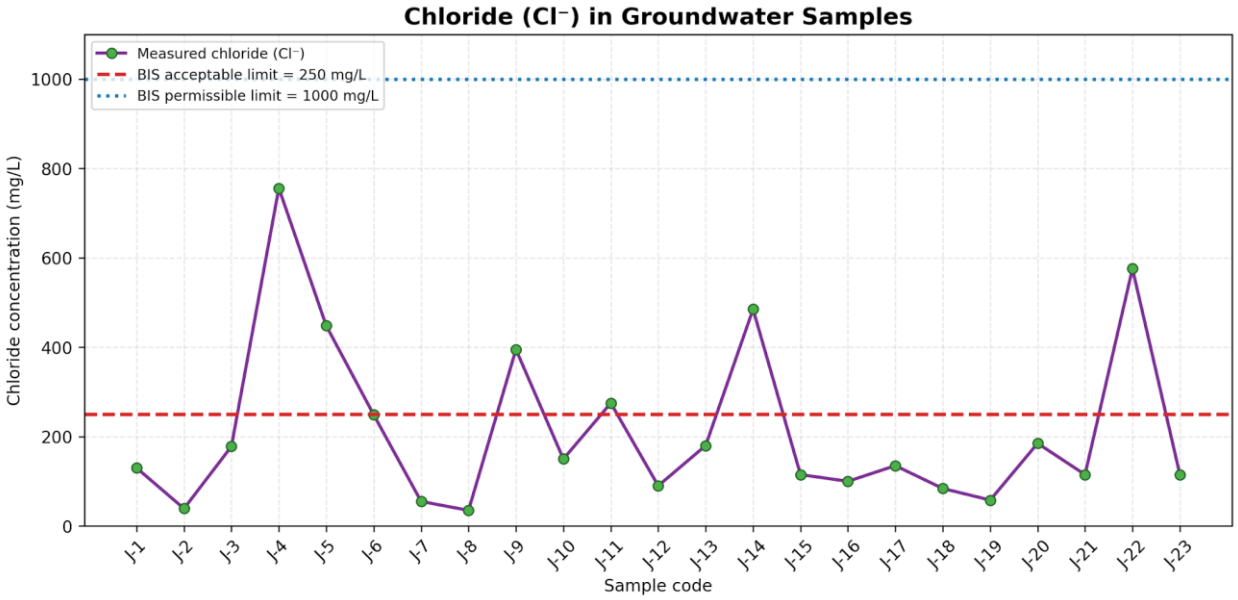



(Sodium concentrations measured in 23 groundwater samples, J-1 to J-23)

### 4.7. Chloride and Fluoride

The permissible limit of chloride in portable water is 200 mg/L (WHO), in Indian conditions the content of Chloride may be accepted up to 1000 mg/L. The chloride content in water samples are in the range of 35 to756 mg/L(Sample J-4) with mean value of 207.103 mg/L. The Fluoride content in the study area is in the range of 0.5 to 5.0mg/L with average value of 2.03 mg/L. The recommended limit of fluoride in drinking water according to WHO is 0.5 to 1.5 mg/L. Fluorosis is observed in some areas due to the high concentration of Fluoride in drinking ground water. High concentration of Fluoride causes dental decay and physical deformation in bones.

**Figure-6: Chloride ($cl^-$) in Groundwater Samples.**




(Chloride concentrations measured in 23 groundwater samples, J-1 to J-23)

### 4.8. Sulphate

The content of sulphur more than 200 mgL is distasteful and disagreeable for domestic uses. The prescribed limit in the presence of sulphate (SO4") creates a gastro intestinal problem when Magnesium and sodium ions are in groundwater. The sulphate content is in the range 27 to 465 mg/L with mean value of 163.478 mg/ L. The maximum permissible value of (SO4") may increase up to 400 mg/L when concentration of magnesium is below 30 mg/ L.

### 4.9. Phosphate

The phosphate concentration in groundwater samples is in the range of 0.4 to 5.55 mg/L with average value of 1.92 mg/L. For the growth of plants, phosphorus is an essential natural inorganic nutrient. Generally low concentrations of phosphorus in groundwater are due to low solubility of phosphorus, minerals and the low ability of soil to retain phosphate.

### 4.10. Nitrate

The high value of the nitrogen inverter sample is due to the excessive use of nitrogenous fertilizers in agriculture. The content of nitrate in the ground water samples is in the range of 0.8 to 82.4 with mean limits of 21.187 mg/L. Maximum contaminated level MCL as NO3' in drinking water is 45 mg/L and as NO3- N is 10 mg/L. The MCL values are recorded to the US Environment Protection Agency (EPA).

### 4.11. Iron (Fe3+)

The content of iron in the water samples is in the range of 0.11 to 0.45 mg/L.Iron concentration in groundwater samples is found within the range of recommended NDWQS and WHO. It is an essential natural inorganic nutrient for the metabolism in cells.

### 4.12. Turbidity

Turbidity of all the samples is in the range as prescribed by ISI: 10500-2012 of one to five NTU.

## 5. Statistical Analysis

Correlation study increase the range of certainty associated with decision-making the correlation coefficient was calculated using the equation:

$$r = \frac{\sum XY}{\sqrt{\sum X^2 + \sum Y^2}}$$

**Table-4: Correlation Coefficients among Different Water Quality Parameters of Ground Water of Jind Block.**

| Parameter | pH | EC | TDS | TH | $Ca^{2+}$ | $Mg^{2+}$ | TA | $Cl^{-}$ | $F^{-}$ | $Na^{+}$ | $K^{+}$ | $SO_4^{2-}$ | $PO_4^{3-}$ | $NO_3^{-}$ | $Fe^{3+}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 1.000 | -0.365 | -0.338 | -0.269 | -0.246 | -0.167 | -0.370 | -0.288 | 0.425 | -0.264 | -0.441 | -0.220 | -0.130 | 0.106 | -0.118 |
| EC | -0.365 | 1.000 | 0.992 | 0.778 | 0.727 | 0.770 | 0.594 | 0.922 | 0.136 | 0.493 | 0.480 | 0.820 | 0.139 | -0.138 | -0.187 |
| TDS | -0.338 | 0.992 | 1.000 | 0.782 | 0.729 | 0.800 | 0.584 | 0.939 | 0.165 | 0.470 | 0.469 | 0.823 | 0.157 | -0.134 | -0.180 |
| TH | -0.269 | 0.778 | 0.782 | 1.000 | 0.962 | 0.903 | 0.550 | 0.727 | 0.003 | 0.334 | 0.508 | 0.659 | 0.078 | -0.125 | -0.278 |
| $Ca^{2+}$ | -0.246 | 0.727 | 0.729 | 0.962 | 1.000 | 0.824 | 0.463 | 0.657 | -0.034 | 0.254 | 0.427 | 0.579 | 0.196 | -0.166 | -0.273 |
| $Mg^{2+}$ | -0.167 | 0.770 | 0.800 | 0.903 | 0.824 | 1.000 | 0.506 | 0.822 | 0.078 | 0.358 | 0.474 | 0.671 | -0.034 | -0.094 | -0.253 |
| TA | -0.370 | 0.594 | 0.584 | 0.550 | 0.463 | 0.506 | 1.000 | 0.502 | 0.042 | 0.411 | 0.771 | 0.374 | -0.039 | 0.340 | 0.004 |
| $Cl^{-}$ | -0.288 | 0.922 | 0.939 | 0.727 | 0.657 | 0.822 | 0.502 | 1.000 | 0.096 | 0.459 | 0.390 | 0.804 | -0.010 | -0.180 | -0.057 |
| $F^{-}$ | 0.425 | 0.136 | 0.165 | 0.003 | -0.034 | 0.078 | 0.042 | 0.096 | 1.000 | 0.251 | -0.365 | 0.324 | 0.071 | 0.083 | -0.176 |
| $Na^{+}$ | -0.264 | 0.493 | 0.470 | 0.334 | 0.254 | 0.358 | 0.411 | 0.459 | 0.251 | 1.000 | 0.226 | 0.437 | 0.076 | -0.023 | -0.013 |
| $K^{+}$ | -0.441 | 0.480 | 0.469 | 0.508 | 0.427 | 0.474 | 0.771 | 0.390 | -0.365 | 0.226 | 1.000 | 0.155 | 0.030 | 0.311 | -0.022 |
| $SO_4^{2-}$ | -0.220 | 0.820 | 0.823 | 0.659 | 0.579 | 0.671 | 0.374 | 0.804 | 0.324 | 0.437 | 0.155 | 1.000 | 0.017 | -0.327 | -0.219 |
| $PO_4^{3-}$ | -0.130 | 0.139 | 0.157 | 0.078 | 0.196 | -0.034 | -0.039 | -0.010 | 0.071 | 0.076 | 0.030 | 0.017 | 1.000 | -0.095 | 0.250 |
| $NO_3^{-}$ | 0.106 | -0.138 | -0.134 | -0.125 | -0.166 | -0.094 | 0.340 | -0.180 | 0.083 | -0.023 | 0.311 | -0.327 | -0.095 | 1.000 | 0.250 |
| $Fe^{3+}$ | -0.118 | -0.187 | -0.180 | -0.278 | -0.273 | -0.253 | 0.004 | -0.057 | -0.176 | -0.013 | -0.022 | -0.219 | 0.250 | 0.250 | 1.000 |

**Interpretation guide:** Values close to +1 indicate strong positive correlation; values close to −1 indicate strong negative correlation; values near 0 indicate weak or no linear correlation. Diagonal values are 1.000.

## 6. Conclusion

Experimental research work on water samples of Jind block, district Jind,Haryana, India was carried out. A total of 23 samples were assembled from the running tube wells and hand pumps. Following the standard procedures soluble cations (Na+,K+, Mg2+,Ca2+) and anion(Cl',SO4"F', NO3')analysed in the water samples. The results of water quality parameters were compared with a standard accessible concentration recommended by the whois ICMR standard of drinking water quality parameters. On the basis of the above result the following conclusion has been drawn: out of 23 samples 16 water samples may be directly used for drinking and domestic

purposes, and remaining 7 samples require proper treatment before supply for drinking and other purposes. The arsenic content (0.85 ppb, was determined in the water samples of Jhanj Khurd (J-9). Arsenic is a serious threat to the health of human beings.

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