WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Comparative Hydrochemical Analysis of Groundwater in Jhaghadia Tehsil of South Gujarat Region

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A B S T R A C T

Groundwater analysis refers to the scientific examination of water resources present beneath the Earth's surface. Groundwater is a crucial natural resource that is essential for human and animal consumption, agricultural irrigation, industrial activities, and many other purposes. Groundwater analysis helps in identifying the quality and quantity of groundwater available, and also determines if it is safe for use. The collected groundwater samples were analyzed for various parameters such as pH, total dissolved solids, turbidity, hardness, alkalinity and other pollutants. The assessment of ground water quality in the villages of Jhagadia Tehsil, Gujarat, was conducted using the Physicochemical analysis to evaluate its suitability for human consumption and ecological sustainability. Total 25 samples of groundwater were collected for the study from 25 villages nearby Jhagadia from different villages, and analyzed for key physicochemical parameters1-10 such as Colour, Odour, pH, conductivity, TDS, Total alkalinity, Hardness and Chloride. All water samples were collected as per SOP11 prescribed by BIS12. In this assessment samples were collected in two batches, batch-1 samples were collected in monsoon season and batch-2 samples were collected in summer season. At the end of the assessment, a comparative study was carried out, and it was found that in few samples, significant change was observed due to seasonal change and majority of samples shown similar to moderate change in both the seasons.

Keywords: Physicochemical analysis, Seasonal Change, Ground water, pH, Conductivity, TDS, Alkalinity

1. Introduction

Water is an essential natural resource that supports life, agriculture, and industrial activities. Groundwater analysis refers to the scientific examination of water resources present beneath the Earth's surface. Groundwater is a crucial natural resource that is essential for human and animal consumption, agricultural irrigation, industrial activities, and many other purposes. Groundwater analysis helps in identifying the quality and quantity of groundwater available, and also determines if it is safe for use. Groundwater analysis involves various techniques and methods to evaluate the physical, chemical, and biological properties of groundwater. Some of the commonly used techniques for groundwater analysis include drilling wells, collecting water samples, and conducting laboratory tests. The collected groundwater samples are analyzed for various parameters such as Colour, Odour, pH, conductivity, TDS, Total alkalinity, Hardness and Chloride. In this assessment samples were collected in two batches, batch-1 samples were collected in monsoon season and batch-2 samples were collected in summer season. At the end of the assessment, a comparative study was carried out, and reported in the form of bar graph.

2. Study Area

Jhagadia is a city in Bharuch district of state of Gujarat, India. It is the headquarters of a taluka of the same name. Jhagadia is a tehsil (taluka) in the Bharuch district of Gujarat, India. It's located south of the Narmada River and is known for its fertile land used for agriculture and its industrial area. The tehsil is home to several villages and the town of Jhagadia itself. **Key features of Jhagadia Tehsil:**

- **Location:** Situated south of the Narmada River in Bharuch district, Gujarat.
- **Economy:** Relies on agriculture (bananas, sugarcane, cotton etc.) and an industrial area (GIDC).
- **Population:** Has a population of 1,85,337 people, with a population density of 229.2 per square kilometer.
- **Villages:** There are 167 villages within Jhagadia Tehsil.
- **Literacy:** The literacy rate is 65.63%.

- **Infrastructure:** Has local government offices, a hospital, and local businesses.

Map of Jhagadia Tehsil, Gujarat state:

Table 1. List of villages from where sample was collected

Sr. No.	Name of the Village	Source of Water
1	Vadhvana	Borewell
2	Hingoriya	Borewell
3	Amod	Borewell
4	Aamalzar	Borewell
5	Mota sorva	Borewell
6	Boridra	Borewell
7	Damlai	Borewell
8	Baleshawar	Borewell
9	Jespor	Borewell
10	Haripura	Borewell
11	Achhalia	Borewell
12	Uchhab	Borewell
13	Malipipar	Borewell
14	Sanjali	Borewell
15	Nava Maljipura	Borewell
16	Rajpardi	Borewell
17	samarpara	Borewell
18	sarsa	Borewell
19	Rajalvada	Borewell
20	Bajrangkori	Borewell
21	sarsa Mandir	Borewell

22	Juna Maljipura	Borewell
23	Gundecha - 1	Borewell
24	Gundecha - 2	Borewell
25	Gundecha - 3	Borewell

3. Materials and Methods

For analyzing the Quality of ground water in villages of Jhagadia Tehsil, 22 villages and total 25 sites were selected for sampling. For ground water analysis, samples were collected as per SOP prescribed by BIS. Samples were collected twice for comparative study. For batch -1 samples were collected in the monsoon season and batch-2 in summer season. For the collection of samples, good quality narrow mouth screw-capped bottles of 250 ml capacity were used. Bottles were firstly washed and then samples were filled in it.

4. Parameters Analyzed

Water samples collected from various locations were analyzed for determination of quality of surface water with respect to the following physicochemical parameters and investigation. Determined value of said parameters is presented in tabular form in table 2 and the determined values were also presented in bar graph format in Fig.1 to 4

1. Colour
2. Odour
3. pH
4. Conductivity
5. TDS

Parameters such as pH ,Conductivity and TDS of all samples were critically analyzed as per BIS methods and precisely recorded for comparative study due to seasonal change if any.

5. Results and discussion

Table 2: Experimental data for parameters pH, Conductivity and TDS of Batch-1 and Batch-2

Parameter	**pH**		**Conductivity (in µs/cm)**		**TDS (in ppm)**	
Sample No.	**Batch -1**	**Batch - 2**	**Batch -1**	**Batch - 2**	**Batch -1**	**Batch - 2**
1	7.6	7.1	365	309	129	166
2	7.3	6.9	1179	668	366	335
3	8.0	6.9	1096	1248	345	620
4	7.3	7.5	1300	861	430	440
5	7.3	7.0	804	576	265	296
6	7.3	7.2	1045	1370	322	912
7	7.4	6.4	878	1305	280	771
8	7.5	7.1	1287	637	400	335
9	7.6	7.7	1572	702	458	352
10	7.5	6.6	801	975	265	440
11	7.7	7.3	834	877	280	296

12	7.9	7.0	992	542	294	352
13	7.9	7.7	1426	671	625	166
14	7.6	7.7	1394	297	458	440
15	7.5	7.2	1355	1269	622	620
16	7.6	7.0	1996	1565	870	912
17	7.6	7.1	1608	855	458	440
18	7.7	6.8	1448	999	458	494
19	7.2	6.8	955	417	304	223
20	7.6	6.8	921	390	294	223
21	7.6	7.3	1414	394	458	405
22	7.9	7.2	854	763	252	383
23	7.6	7.4	1122	1239	370	834
24	7.7	7.1	1582	1113	358	551
25	7.0	6.8	1186	714	400	369

Figure 1.1 : Graphical representation of experimental data of pH of Batch-1

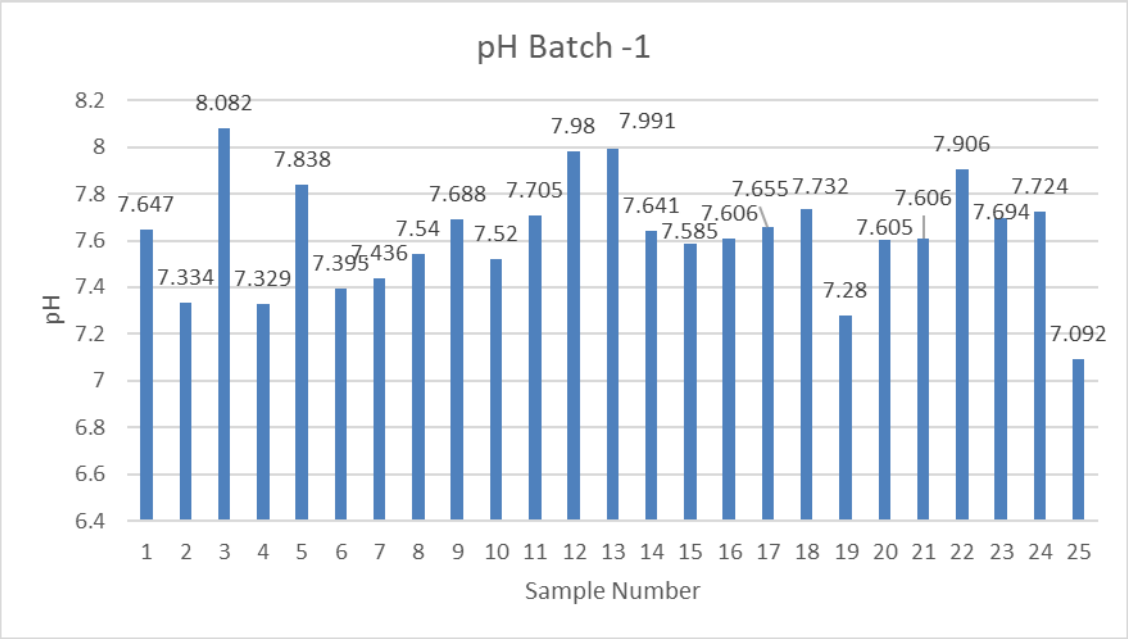


Figure 1.2 : Graphical representation of experimental data of pH of Batch-2

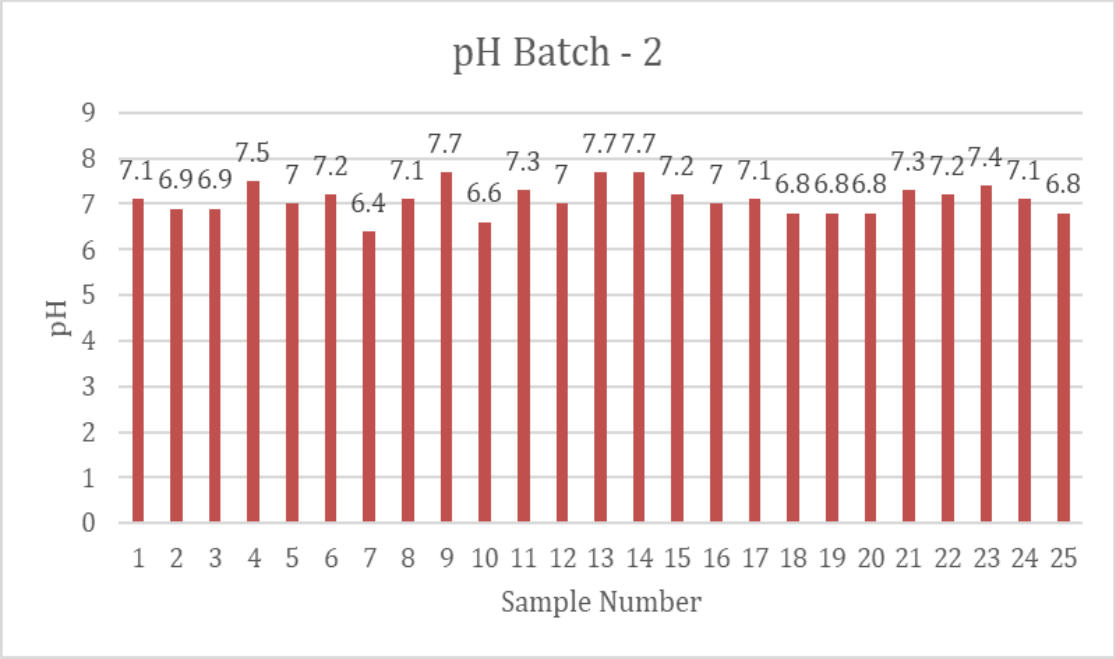


Figure 2.1: Graphical representation of experimental data of conductivity of Batch-1

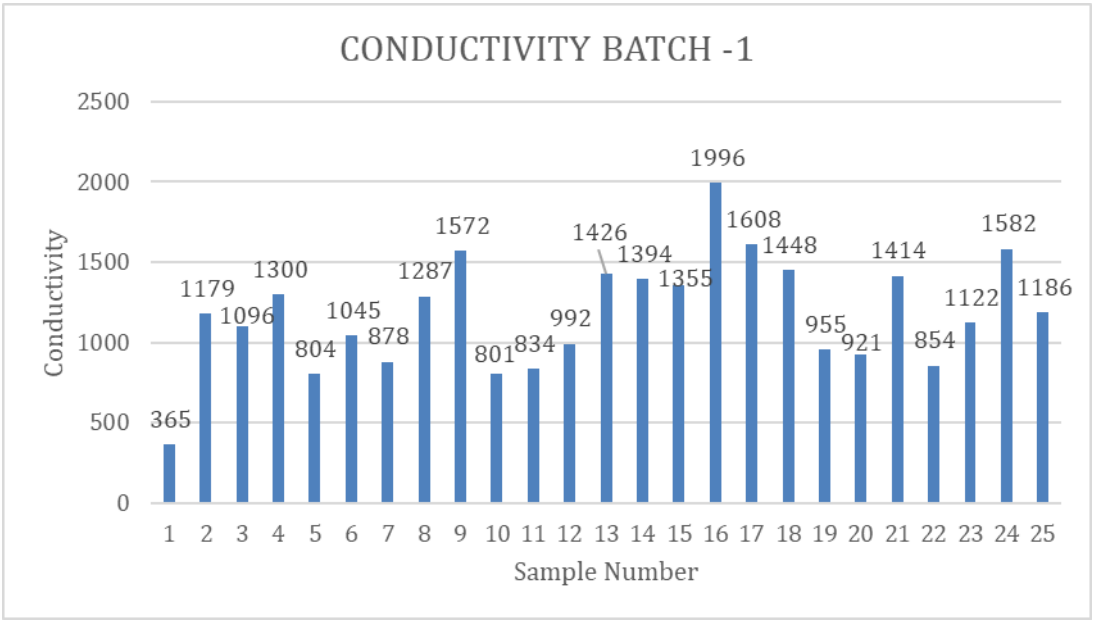


Figure 2.2: Graphical representation of experimental data of conductivity of Batch- 2

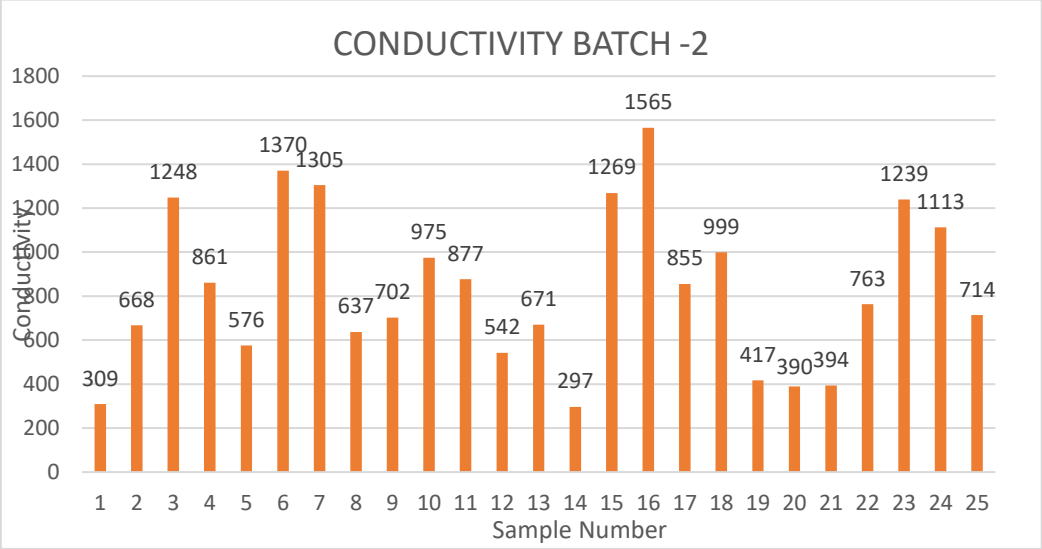


Figure 3.1 Graphical representation of experimental data of TDS of Batch-1

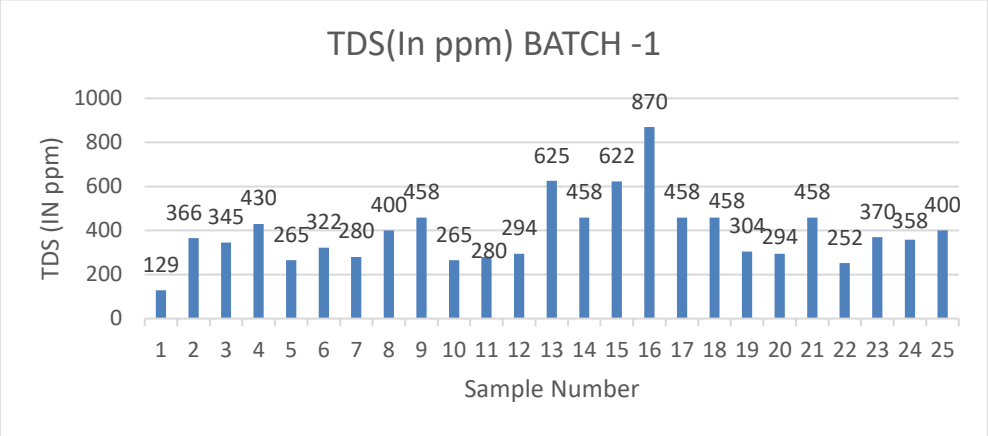


Figure 3.2: Graphical representation of experimental data of TDS of Batch-2

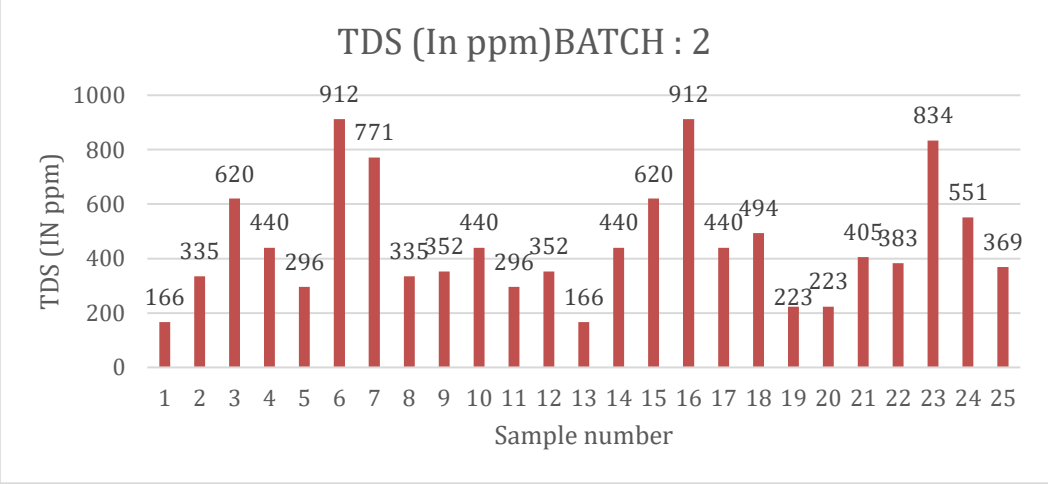


Figure 4.1: Bar graph of comparative seasonal change in pH of water samples (sample Nos. 1 to 25)

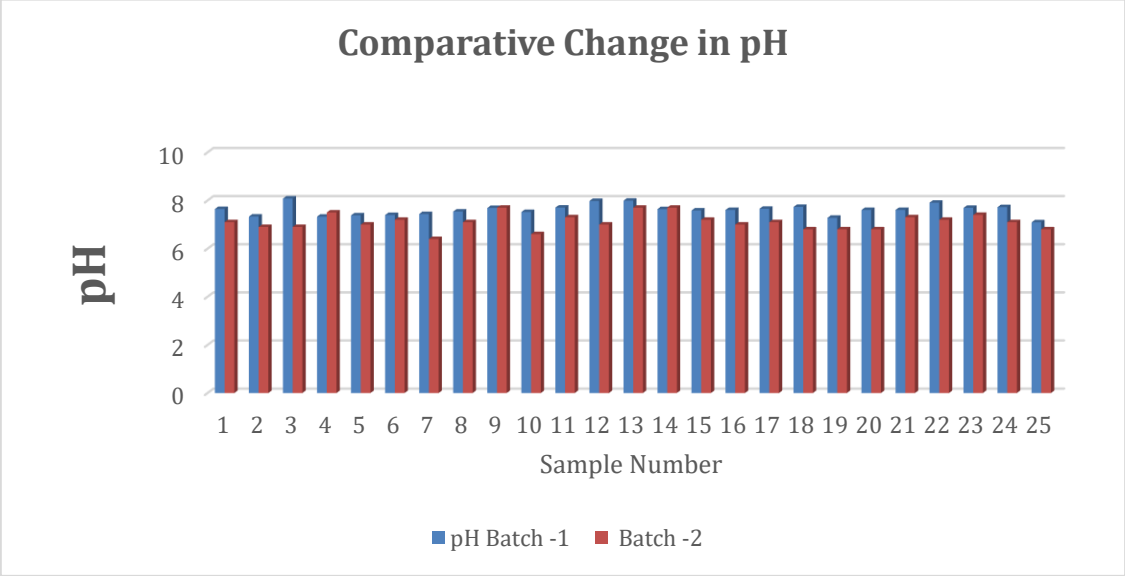


Figure 4.2: Bar graph of comparative seasonal change in Conductivity of water samples (sample Nos. 1 to 25)

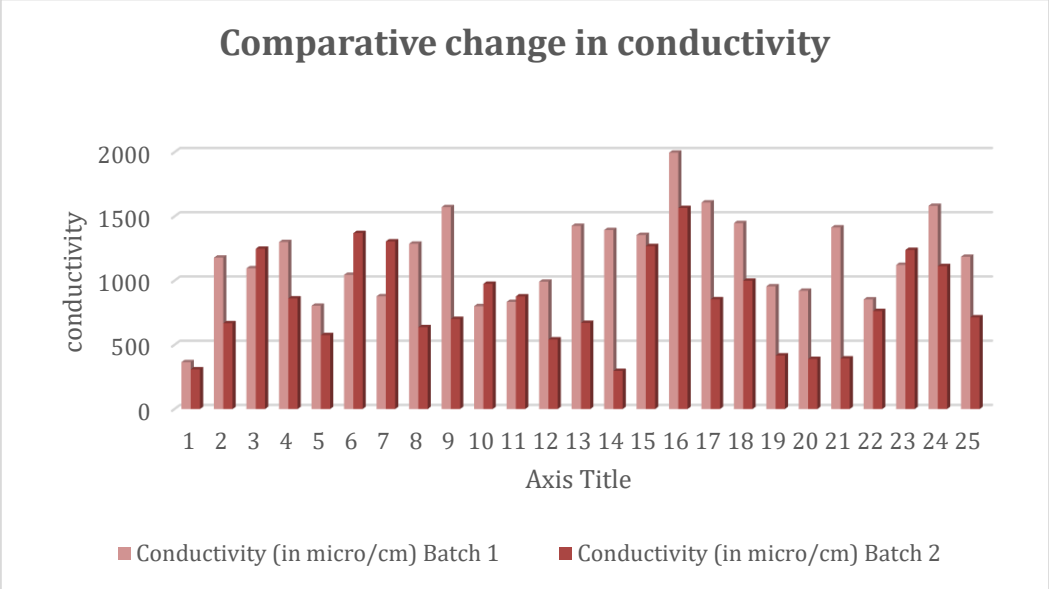
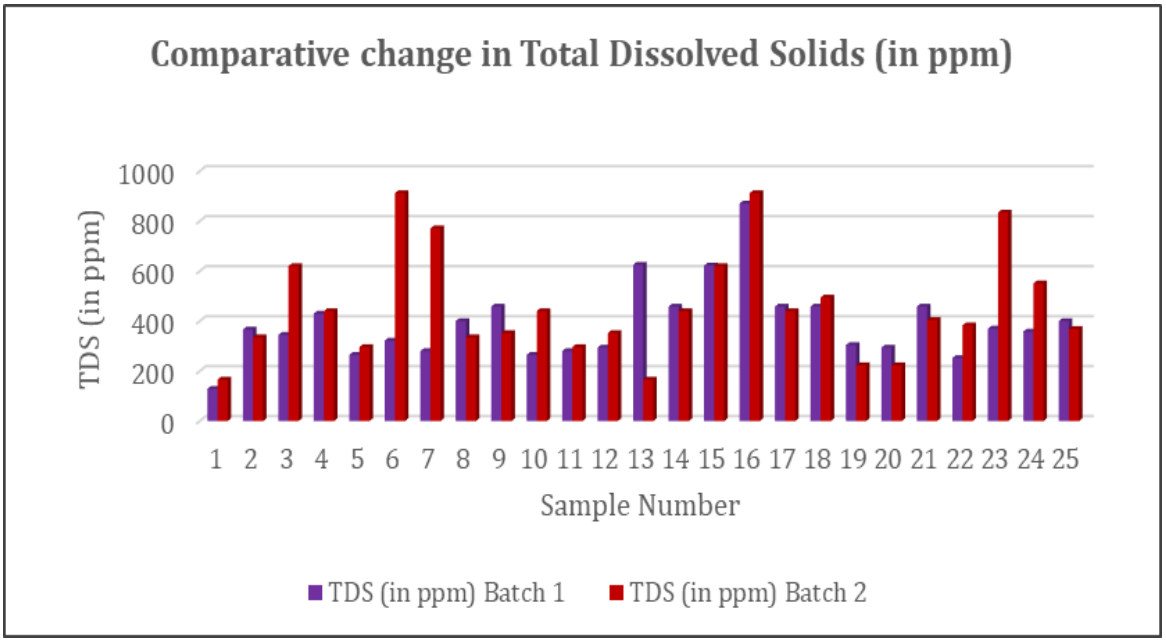


Figure 4.3: Bar graph of comparative seasonal change in TDS of water samples (sample Nos. 1 to 25)



6. Conclusion

pH: From the study it was found that pH of all the samples collected were observed within the limit prescribed by Bureau of Indian Standards (BIS). Highest pH determined the value of 8.16 and Lowest pH of 6.60 were observed in Bortimba and Ram Lake (Jhagadia) respectively. The pH of all the samples found around seven and close to neutral pH. It was also observed that during seasonal change pH of most of the water samples found to decrease in batch-2 samples as compared to batch-1.

Conductivity: The conductivity of ground water was found in all the 25 samples exceeding the limit prescribed by BIS. The highest conductivity recorded was 1996 $\mu S/cm$ from Rajpardi and the lowest Conductivity was 297 $\mu S/cm$ from sanjali was observed. It was also observed that during seasonal change conductivity of most of the water samples found to vary in random fashion.

TDS (Total Dissolved Solids): Total Dissolved Solids of all 25 samples were found to exceeding the limit prescribed by BIS. from the study, sample no.16 recorded the highest TDS of 929 ppm and sample no.1 recorded the lowest TDS of 129 ppm in villages of Rajpardi and Vadhvana respectively. It was also observed that during seasonal change TDS of most of the water samples found to increase in summer season.

This study describes that the ground water quality in villages of Jhagadia Tehsil is normal. The study shows that the samples have not much need for any purification. It was also concluded that except TDS no significant seasonal change was noticed due to seasonal change.

Acknowledgement

The authors are thankful to residents of various villages of Jhagadia tehsil for their cooperation in collection of water samples. Authors are also thankful to all the authorities of Indian Institute of Teacher Education (IITE) for laboratory facilities and continuous support at every stage of this research work.

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