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Seasonal Assessment of Ground water Quality in Gorakhpur City

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Abstract - *One of the main sources of drinking water in Gorakhpur city is groundwater (India.). 10 sampling locations were chosen for this study's examinations into 10 physical-chemical parameters. Between January 2022 and May 2022, during pre- and post-monsoon months, the work was completed. For assessing water quality, the datasets were subjected to the Hortons method analysis in order to look at seasonal variations in groundwater quality. According to drinking water standards, the average values of pH, turbidity, TDS, total hardness, alkalinity, chloride, nitrate, arsenic, sulphate, and iron content are all within acceptable limits. Additionally, it was found that the parameter's mean values varied relatively little between samples, as opposed to the larger variance seen across.*

Key Words: *Seasonal Assessment, Ground water, Ph, TDS, Iron, Hardness*.

1. INTRODUCTION

Water is critical and mainly used natural resources. It is fundamental unit of the environment to sustain all reasonably life during this planate. Elevated water demand in agricultural likewise as industrial sector has been shown in developed country because of unpredicted population growth; urbanization, advancement of technology and better standards of living. From the full available water on earth only 0.16% is suitable for individual consumption and therefore the remaining is polluted because of various ecological reasons. Without water, life wouldn't be sustained on earth since all the plants and animals contained water around 60% by volume.(Tiwari et al., 2014) Discharging the domestic sewage and industrialized effluents into natural stream is one in every of the reason thanks to which water resources has become polluted in India or in developing countries.(Saeedi et al., 2009) Groundwater pollution has become a major subject of public concern over the world since water quality performs important role for all living beings. Water quality is a term that is repeatedly defined among marine scientists, engineers, managers, and guiding principle. Assessment of water quality impairment presents challenges to water resource planners. The sequence of changes in quality characteristics of water because of various reasons, in nowadays have become the topic of diverse investigations which played a substantial role in assessing water quality.(Verma et al., 2013) Also the possible correlations among these parameters, significant ones fairly indicate the quality of drinking water in Gorakhpur city. Ground water samples were taken at several locations across Gorakhpur. Physico-chemical properties of the samples were examined using the established analytical techniques of IS:3025.(Krishna et al., 2014) A number of variables were measured, including pH, turbidity, iron, nitrate, chloride, total dissolved solids, sulphate, arsenic, and alkalinity. Results demonstrate that ground water samples, with the exception of total hardness and total dissolved solids, showed only modest seasonal variations in physical-chemical constituent concentration.(Districts et al., 2021) With the exception of TDS and total hardness, ground water had the highest concentration of maximal inorganic components during the post monsoon season. Effective use of the Water Quality Index to access groundwater quality in space and to depict seasonal changes in groundwater quality characteristics.(JHARIYA et al., 2018).

1.1 Study Area

Gorakhpur is located in the Tarai region of the rivers Rapti and Rohni at 26°45' north latitude and 83°22' east longitude. It is located close to the Nepali border in the eastern section of the Indian state of Uttar Pradesh. the largest settlement on the Transghagar Plain. The name of the city was chosen in honors of Saint Guru Gorakhpur, who lived in the 12th century. Being situated close to the border between India and Nepal and having excellent rail connections makes the city's location extremely advantageous. which has a population of roughly 6, 71,048 lakhs and is famous for the Gorakhnath temple and Gita Press, is the main town of eastern Uttar Pradesh.

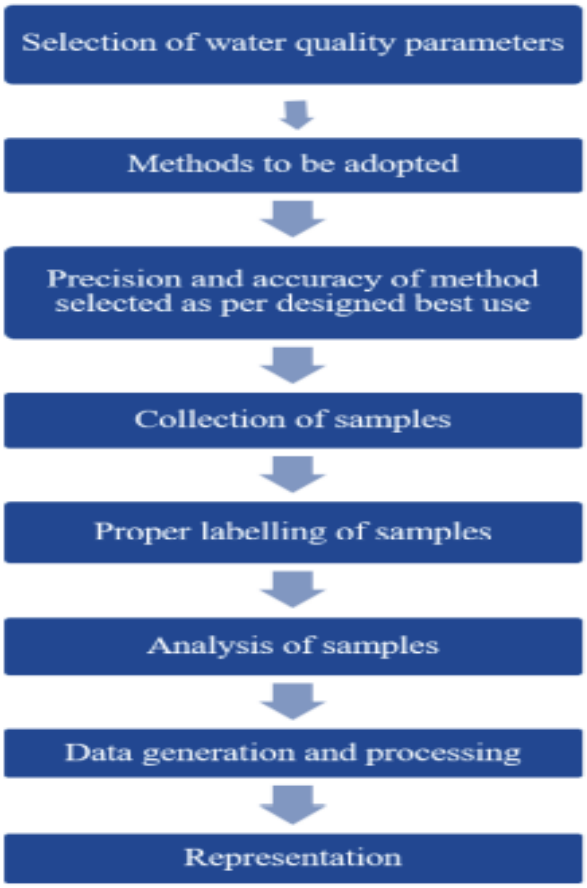
2. MATERIALS & METHODOLOGY

Water samples were taken from the shallow deep hand pump and India mark II placed in 2 litre sterile plastic containers. In order to determine the physical and chemical characteristics of the ground water samples, such as pH, TDS, turbidity, alkalinity, TH, chloride, arsenic, sulphate, nitrate, and iron, conventional analytical procedures detailed in (IS 3025). Gorakhpur District were chosen. For physico-chemical examination, the materials were collected in sterilized one-liter plastic bottles. The samples were taken from India Mark-II hand pumps placed by government organizations as well as shallow depth hand pumps installed by locals for drinking water. The samples were examined in accordance with the established protocols. All samples came from those locations where drinking-quality ground water was being extracted.(Singh & Gupta, 2022)For each season,

groundwater sample quality parameters are evaluated (pre & post monsoon). The general procedures followed for water quality analysis were represented using flow chart.(JHARIYA et al., 2018)

Table 1 Parameters of water with their permissible limits of drinking water, recommended agency and unit weights.

S. No.	Parameters	Standard Values	Recommended Agency	Unit Weight
1.	pH	6.5-8.5	BIS:10500 :2012	0.001135
2	Turbidity	5 NTU	BIS:10500 :2012	0.001929
3	Iron	0.3 mg/l	BIS:10500 :2012	0.032
4	Sulphate	200mg/l	BIS:10500 :2012	0.00004822
5	TDS	500mg/l	BIS:10500 :2012	0.00001929
6	TH	200mg/l	BIS:10500 :2012	0.00004822
7	Alkalinity	200mg/l	BIS:10500 :2012	0.00004822
8	Chloride	250mg/l	BIS:10500 :2012	0.00003858
9	Nitrate	45mg/l	BIS:10500 :2012	0.0002143
10	Arsenic	0.01mg/l	BIS:10500 :2012	0.964



Flowchat for procedures for water quality analysis

3. RESULTS AND DISCUSSION

Table 2. Result of Analysis of Groundwater Quality Parameters

Parameters	Pre-monsoon	Post-monsoon
pH	7.12	7.035
Turbidity	1.96	1.94
TDS	195.7	215.8
TH	270.63	278
Alkalinity	102.4	101.7
Chloride	86.66	81.66
Iron	1.77	1.474
Nitrate	8.12	9.377
Sulphate	46.975	46.75
Arsenic	0	0

Table 2 presents the results of the physicochemical parameter analyses, the means of the variables, and the special and temporal variation that they reflect. Visually. Results should be compressed. Considering the evaluated quality metrics and associated requirements for drinking water provided by (BIS: 2012). The value of hydrogen ion concentration determines whether water is acidic or basic. The current investigation clearly showed that the pH within the BIS 2012 limit recorded ranges between 6.65 and 7.45 before monsoon and 6.78 and 7.49 after monsoon season (Fig.1). pH values above 7.0 may result in incrustation, residue deposits, and trouble chlorinating water to sterilize it, whereas pH values below 7 may result cause tuberculation and rust. The World Health Organization recommends a pH value of 6.5 or higher for drinking water to prevent corrosion, and in most global drainage basins, a pH value between 6.5 and 8.5 generally indicates adequate water quality. Water turbidity, which is caused by substances existing in suspended form, represents how clear the water is. In the chosen location, average turbidity readings were 1.69 during premonsoon and 1.94 during postmonsoon. Premonsoon and postmonsoon seasons are when turbidity changes (Fig.2). Surface water contamination can occur in shallow or poorly constructed wells or springs, especially during spring runoff or periods of severe rainfall. Due to flooding during the rainy season, copious amounts of rain, and runoff from agricultural regions, turbidity levels were quite high. Groundwater turbidity is primarily inorganic and brought on by natural geological processes. High turbidity levels or abrupt fluctuations in turbidity have been seen in this region as a result of the area's water systems' reliance on shallow or poorly constructed bodies of water. TDS levels in water are a good indicator of salinity. It includes all of the other solids and mineral components that are dissolved in the water. The study's mean TDS values

varied, and they were supported by a number of sources. 125 mg/L to 281 mg/L and 140 mg/L to 280 mg/L, respectively, concentrations according on the seasons (pre & post monsoon). Additionally, Fig. 3 shows the variation in TDS of groundwater samples during both seasons. The BIS recommended guidelines value of 2000 mg/L was used to classify the examined water samples as acceptable. The presence of sulphates and chlorides in the water—which may originate from natural sources, sewage effluents, urban runoff, etc.—founded the somewhat higher TDS concentrations in groundwater. TDS readings that are high affect flavour. Although the alkalinity level in the research area's ground water is within normal limits, seasonal variations can be seen. 128 mg/L of alkalinity was found in the summer sample (pre-monsoon), which was followed by 122 mg/L in the winter (post monsoon). The mild alkalinity in groundwater samples may be the result of increased effluent, domestic sewage, etc. leaching. While hard water is undesirable for washing clothes and using in the home since it uses a lot of soap. In this study, hardness fluctuates across the range of 194 mg/L to 516 mg/L and 190 mg/L to 560 mg/L in the pre- and post-monsoon seasons, respectively, and is above the acceptable limit in both seasons. Chloride levels in natural water bodies are influenced by industrial processes, agricultural practises, and the presence of rocks that have been exposed to chloride. According to a study, the content of chloride was 86.66 mg/L in the summer (premonsoon) and 81.66 mg/L in the winter (postmonsoon). Figure 6 depicts the variation in chloride levels during the two seasons. Since groundwater is a recipient of sewage effluent, farm drainage, and municipal garbage, it has a makeable chloride concentration added to it. The chloride concentration in the ground will inevitably rise as a result of sewage effluents being used as water sources, giving water and other liquids an unpleasant taste. A crucial consideration in determining natural water's suitability for communities is its sulphate content. In the premonsoon and postmonsoon seasons, the observed value of sulphate ranges from 41.57 mg/L to 46.97 mg/L, respectively. Sulfate16 is present because to the leaching of salts and other minerals, as well as the outflow of home sewage and manufacturing waste in this area. High sulphate concentrations in water bodies have harmful effects on fish life and cause diarrhoea and other gastrointestinal problems in humans. The results of the Nitrate and Iron there are almost no unusual changes in nitrate of water samples.

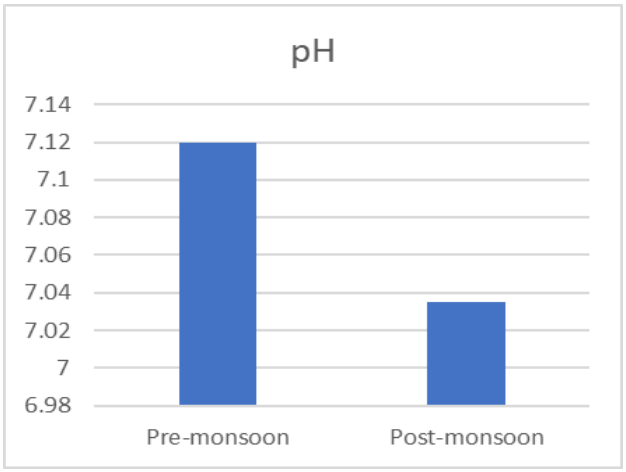


Fig -1 pH of the Pre and Postmonsoon

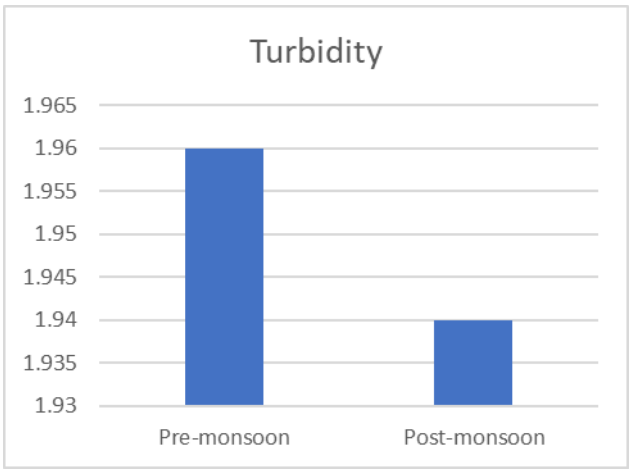


Fig-2 Turbidity of the Pre and Postmonsoon

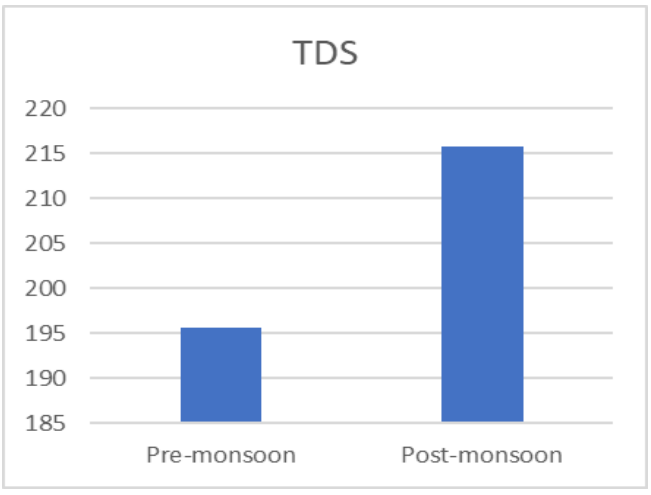


Fig-3 TDS of the Pre and Postmonsoon

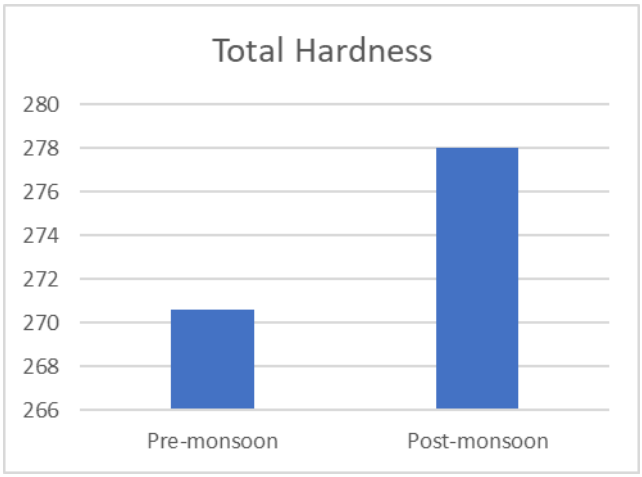


Fig-4 Total Hardness of the Pre and Postmonsoon

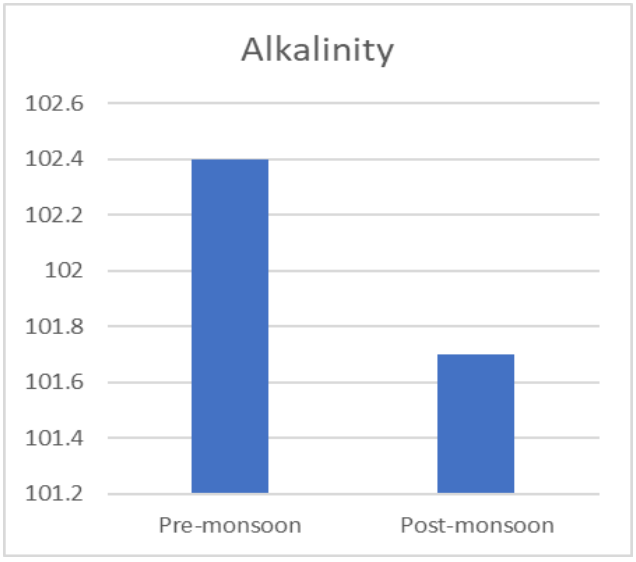


Fig -5 Alkalinity of the Pre and Postmonsoon

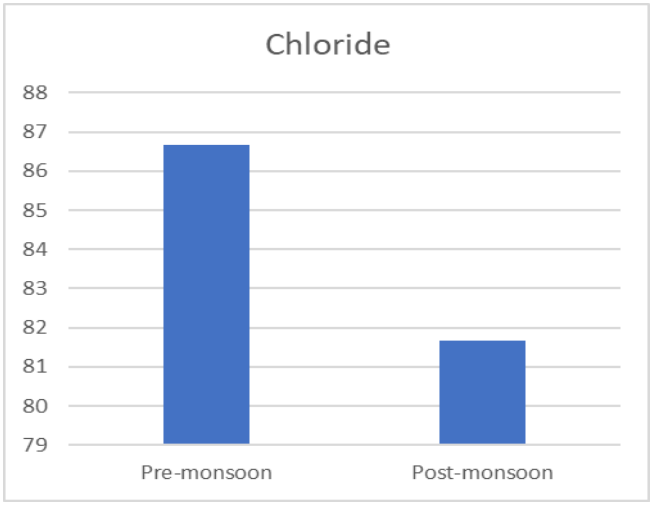


Fig-6 Chloride of the Pre and Postmonsoon

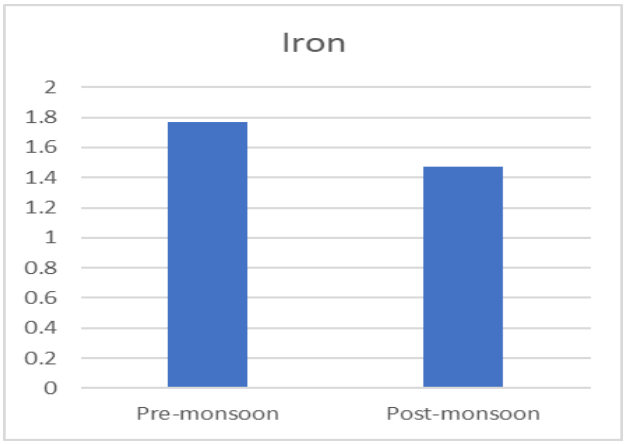


Fig-7 Iron of the Pre and Postmonsoon

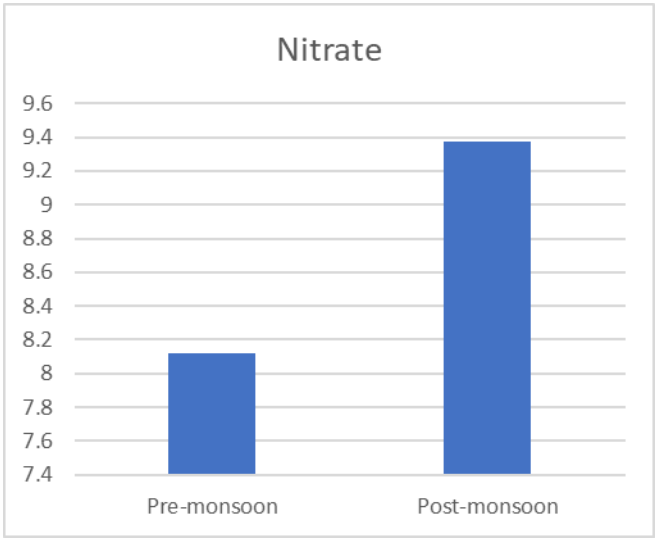


Fig-8 Nitrate of the Pre and Postmonsoon

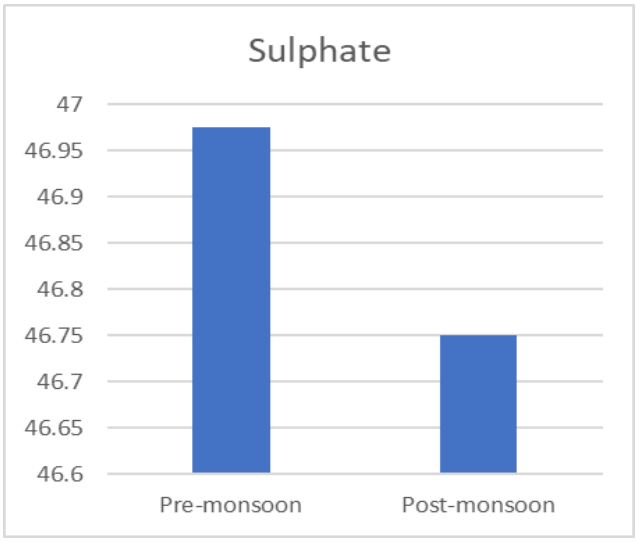


Fig- 9 Sulphate of the pre and postmonsoon

3. CONCLUSION

Understanding groundwater quality is essential because it is the primary factor determining whether it is suitable for intended best use. In the vicinity of the sewage treatment plant, the physicochemical properties of groundwater samples from randomly chosen diverse water sources (India mark II, shallow deep hand pump) were examined to assess the potential quality of the groundwater. For the residents in the study area, boreholes and hand pumps are the main sources of water (for drinking and domestic needs). The bulk of the chosen characteristics, with the exception of turbidity, are within the range that is acceptable for drinking water. The research demonstrates that groundwater is safe for human consumption and public health.

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