



Evaluate Groundwater Contamination status of Sawai Madhopur District (Rajasthan)

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Abstract

Groundwater is the most significant universal natural resource for the monetary improvement and secure provision of consumable water supply in both urban and rural areas. Groundwater suitability for drinking and other purposes mainly depends on the types of ion and their concentration present in it. The study was carried out to assess the groundwater quality in Sawai Madhopur District. The quality was assessed in terms of physicochemical parameters. Groundwater samples were collected from forty locations in Sawai Madhopur District. The physico-chemical parameters such as pH, electrical conductivity, Total Dissolved Solids (TDS), fluoride content and Dissolved Oxygen (DO) were analysed (APHA, 2005) to study the present status of the groundwater quality in different seasons as during pre-monsoon, monsoon and post-monsoon season. The results were compared to the standards of the WHO. Our research indicates that the average pH, electrical conductivity and total dissolved solids value of groundwater is higher during the pre-monsoon period, as compare to the monsoon and post-monsoon season.

Keywords- Groundwater, Sawai Madhopur, physicochemical parameters, Dissolved Oxygen (DO).

Introduction

Groundwater has been known as the second largest freshwater storage in the world, following surface water. A crucial natural resource, groundwater sustains ecological, industrial, and agricultural demands while

providing millions of people worldwide with their main supply of drinking water. Groundwater, which is kept underground in aquifers, is essential to preserving water security¹.

Despite this, groundwater is the most delicate resource and is frequently underappreciated and mishandled. Mismanagement, compounded with the fact that groundwater is a shared resource and is susceptible to the problem of the 'tragedy of commons', has led to its systematic, uncontrolled, and unsustainable abstraction. In addition to the quantity, groundwater quality has deteriorated, rendering it unfit for consumption and use². Being a prerequisite for health and well-being, 80 % of all illnesses and fatalities in the developing world are water-related³⁻⁴.

India and other developing nations have a high demand on natural resources, particularly water, which is scarce and must be preserved for coming generations. The United States, China, and India use 16.3, 14.9, and 11.21% of the world's freshwater resources, respectively, making up around 42.5% of the total. In the Indian subcontinent, the strain on groundwater resources has multiplied due to industrialisation and the green revolution⁵.

The contamination of groundwater in Rajasthan has been highlighted by the Central Ground Water Board CGWB (2021), India, which observed that between 40 and 56 percent of groundwater samples in the state's districts of Barmer, Dausa, Tonk, Jaipur, and Jodhpur have electrical conductivity (EC) above the permissible limit, i.e., greater than 3000 $\mu\text{S}/\text{cm}$. In addition, roughly 40 and 31 % of groundwater samples in Barmer and Jaipur exceeded the permissible chloride (Cl^-) limit of $>1000 \text{ mg}/\text{L}$. In approximately 67 percent of Tonk's groundwater samples, the sulphate (SO_4^{2-}) concentration exceeded 400 mg/L (the maximum permissible limit). Further, more than 50 percent of the groundwater samples in Barmer and Jodhpur contained nitrate (NO_3^-) concentrations exceeding 45 mg/L. Also, the districts of Tonk, Barmer, Ajmer, and Jaipur were found to be afflicted by fluoride (F^-) contamination.

To determine the amount, causes, and effects of groundwater contamination in the Sawai Madhopur area and to create plans for pollution prevention and sustainable groundwater management. Its objective is to identify various diseases that are now present in the water of the location that was selected.

Martials and Methodology

Study Area-

The district of Sawai Madhapur in the Indian state of Rajasthan is a significant hub for water and agricultural resources. Sawai Madhopur district is located in the eastern part of Rajasthan State and lies between 25°44'59" and 26°45'00" North latitudes and between 75°59'00" and 76°58'50" East longitudes. Administratively, the district is divided into seven tehsils viz. Gangapur, Bamanwas, Malarna Dungar, Bonli, Chouth Ka Barwara, Sawai Madhopur and Khandar.



Fig.: Geographical location of Sawai Madhopur in Rajasthan

Because of its dry environment and lack of water, the Sawai Madhopur district in Rajasthan is vulnerable to groundwater pollution. Due to industrialization and urbanization, the groundwater of Rajasthan's Sawai Madhopur area has become dangerously contaminated⁶.

Table- Sampling sites of various town/ cities of Sawai Madhopur District

Sample No.	Block/City	Study Sites (Sampling Sites)	Sample No.	Block/City	Study Sites (Sampling Sites)
1-5	Sawai Madhopur	Collectorate office, Sawai Madhopur	21-25	Wazirpur	SDM office Wazirpur
		Govt. Sen. Sec. School, Mount town			Govt. Sen. Sec. School, Wazirpur
		Near Parking of Ranthambhore Fort			Govt. Sen. Sec. School, Parita
		Railway Station, Sawai Madhopur			Bus Station Wazirpur
		Cement Factory, Sawai Madhopur			Govt. Sen. Sec. School, Shyaroli
6-10	Gangapur City	SDM office Gangapur City	26-30	Chauth Ka Barwada	SDM office Chauth Ka Barwada
		Govt. Sen. Sec. School, Gangapur City			Govt. Sen. Sec. School, Chauth Ka Barwada
		Near Atal Bihari Mandir Toksi			Near Chauth Mata Mandir

		Village			
		Railway Station Gangapur City			Railway Station Chauth Ka Barwada
		Govt. Sen. Sec. School, Jat Baroda			Bus Station Chauth Ka Barwada
11-15	Malarna Doongar	SDM office Malarna Doongar	31-35	Bonli	Peepalda Village Bus Stop
		Govt. Sen. Sec. School, Malarna Doongar			Govt. Sen. Sec. School, Bonli
		Bus Station, Malarna Doongar			Near Sati Mata Mandir, Bonli
		Railway Station, Malarna Doongar			Mitrapura Bus Station
		Bus Stop, Bahter Village			Bus Station Bonli
16-20	Khandar	SDM office Khandar	36-40	Bamanwas	SDM office Bamanwas
		Govt. Sen. Sec. School, Khandar			Govt. Sen. Sec. School, Bamanwas
		Govt. Sen. Sec. School, Baler			Govt. Sen. Sec. School, Piplai
		Bus Station Khandar			Piplai Village Bus Stop
		Near Khandar Fort			Bamanwas pond Bamanwas

Sampling Procedure

The samples for conducting this study were collected from various chosen locations. The locations were analyzed in the parameter related to determining the level of pollution. A Glass or polyethylene bottle with capacity of minimum 3.0 liters was used to collect the effluent samples from the sampling point for analysis⁷⁻⁸.

Ground water analysis:

Physical and chemical parameters are involved in maintaining quality of water. The physical parameter includes pH, electrical conductivity, Total Dissolved Solids (TDS), fluoride content and Dissolved Oxygen (DO) the chemical parameter comprises the various types of chemical constituent present in water in different seasons according to APHA protocol⁷⁻¹¹.

Observation and Discussion

This investigation of groundwater in Sawai Madhopur, Rajasthan, is very important since it aims to identify and treat the underlying causes and effects of the district's declining water quality. The district has been motivated by this to look at measures to lower the danger of groundwater pollution. Evaluating the physicochemical properties of water is essential for determining the condition of any aquatic ecosystem⁶.

pH:

Seasonal changes in the concentration of certain pollutants or effluents are indicated by pH fluctuations, which lead to changed pH values. In our finding, average pH value of ground water is 8.375 in Pre monsoon whereas average pH in monsoon and post monsoon is 7.383 and 8.371 respectively. The greatest pH value was recorded in the pre monsoon, while the lowest was observed in the monsoon. Further increasing trend of pH was observed in post-monsoon season and it may be due to decrease in water level which leads to increase in the concentration of minerals, salts and ionic compounds and reduction in the quantity of rain water containing waste¹²⁻¹³.

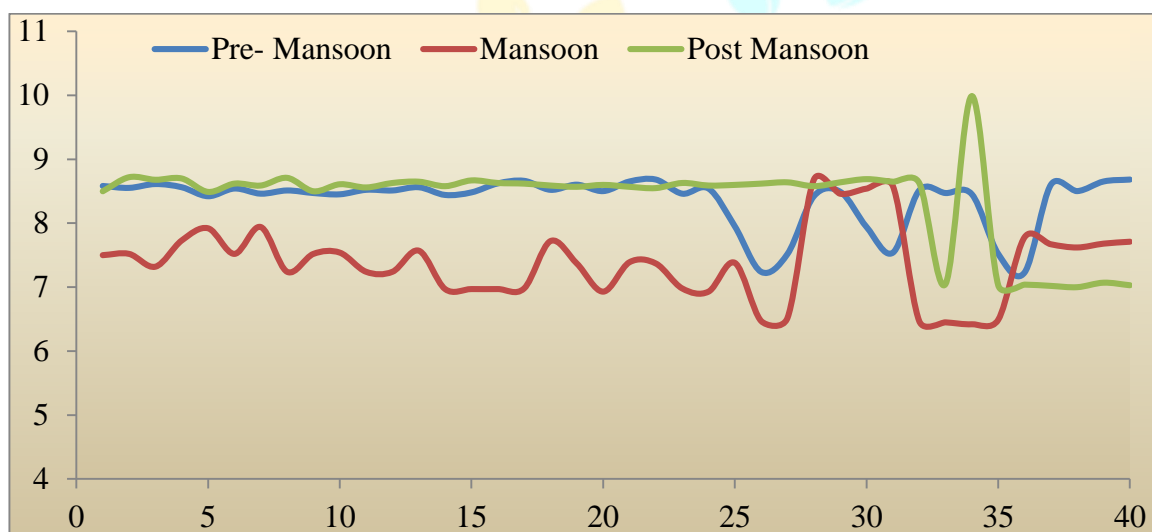


Fig- pH of water at various sites during pre-monsoon, monsoon and post-monsoon season (Total sample -40)

Electrical Conductivity (EC)

An important indicator of groundwater quality and an indication of a salt danger is electrical conductivity¹⁴. According to our findings, the average EC value of ground water is 528.5 $\mu\text{S}/\text{cm}$ in the pre-monsoon, while it is 426.8 $\mu\text{S}/\text{cm}$ during the monsoon and 364.3 $\mu\text{S}/\text{cm}$ during the post-monsoon.

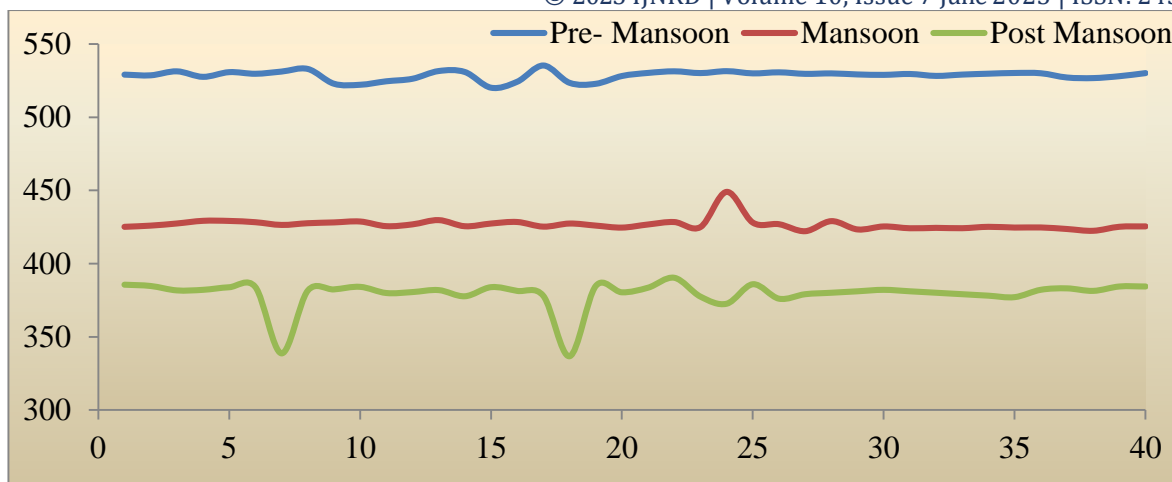


Fig- Electrical Conductivity ($\mu\text{S}/\text{cm}$) of water at various sites during pre-monsoon, monsoon and post-monsoon season (Total sample -40)

Total Dissolved Solids

Total dissolved solids are substances in the water that passes through a filter that have a theoretical average pore size of $2.0\ \mu\text{m}$ or less. Higher values of TDS elevate the density of water. Higher dense water has lesser gas solubility which decreases the superior quality water availability for drinking, irrigation, industries and for other water related uses¹⁵.

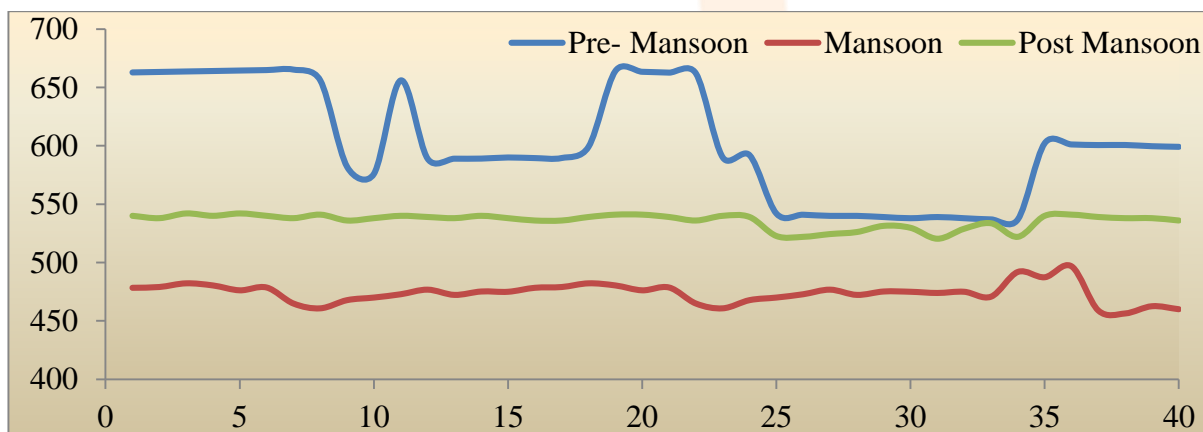


Fig- Total dissolved solids of water at various sites during pre-monsoon, monsoon and post-monsoon season (Total sample -40)

Our research indicates that the average total dissolved solids value of groundwater is $602.1\ \text{mg}/\text{l}$ during the pre-monsoon period, whereas the average values during the monsoon and post-monsoon periods are $473.9\ \text{mg}/\text{l}$ and $535.8\ \text{mg}/\text{l}$, respectively.

Fluoride (as F⁻)

Fluoride is an essential anion to prevent dental caries, if its intake is less than 1ppm (BIS, 2012). However, if concentration of fluoride exceeded their permissible limit (>1.5ppm), essential fluoride anions convert into contaminants and pollute the water sources. In physico-chemical analysis periodic variation of average fluoride content was noted and found to be 0.5165 ppm for pre monsoon period, 0.6713 ppm for monsoon and 0.07075 ppm for post-monsoon period.

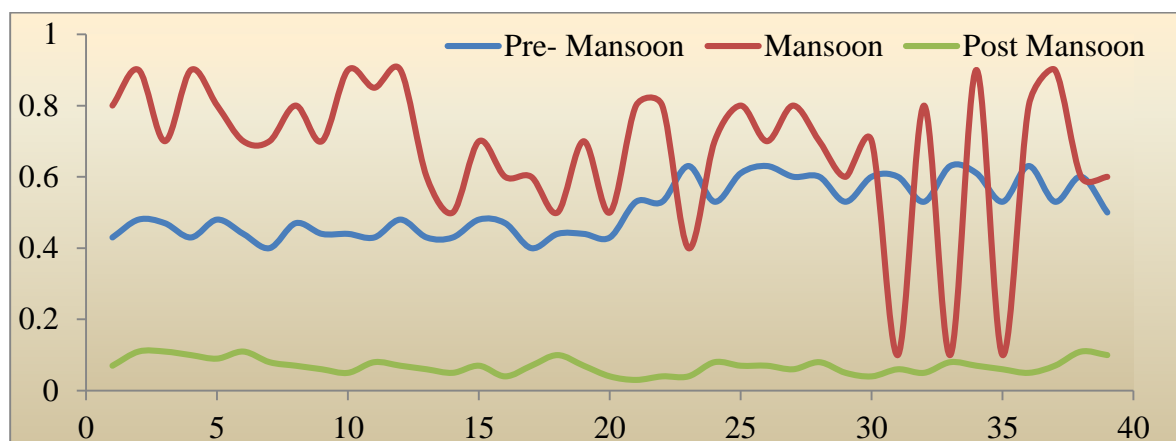


Fig- Fluoride concentration of water at various sites during pre-monsoon, monsoon and post-monsoon season
(Total sample -40)

Dissolve Oxygen (DO) mg/l

Additionally, oxygen exhibits its solubility in water, which is crucial in assessing the quality of the water and makes it the primary test for regulating water pollution policies¹⁶. Higher concentrations of organic pollutants are often associated with lower dissolved oxygen levels¹⁵. In our finding, average dissolved oxygen value of ground water is 5.800 mg/l, in Pre monsoon whereas average dissolved oxygen value in monsoon and Post monsoon is 4.930 mg/l and 5.902mg/l respectively. As per WHO and BIS standards¹⁶⁻¹⁷, the healthy water should generally have Dissolved Oxygen concentrations within 6-10 mg/l.

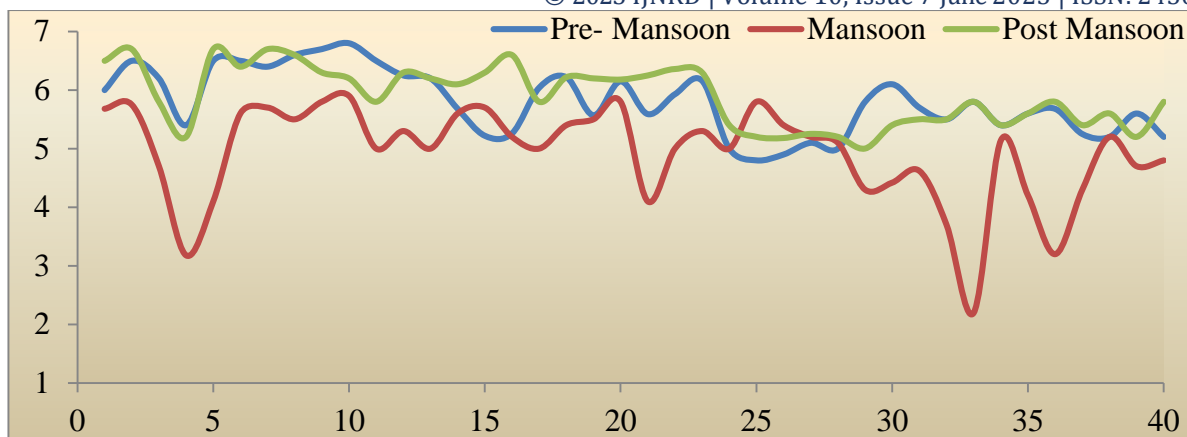


Fig- Dissolved oxygen value of water at various sites during pre-monsoon, monsoon and post-monsoon season (Total sample -40)

Conclusion

This study seeks to increase knowledge of the regional water quality, pinpoint viable remedies, and provide suggestions for dealing with the problem of groundwater pollution in the area. Furthermore, these studies provide trustworthy data that may be a useful tool in creating strategies that will guarantee a safe groundwater supply in the future. The investigation was concentrated on identifying the contamination's origins and causes as well as any potential health implications. Collaborative efforts involving governments, industries, communities, and researchers can ensure the sustainable use of groundwater for future generations.

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