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Seasonal changes of Physiochemical properties of Groundwater at Sawai Madhopur District in Rajasthan

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Abstract: Rajasthan, the largest Indian state, is predominately arid and semi-arid, where groundwater provides approximately 90 % of drinking water and 70 % of irrigation water requirements.The hydrochemistry of groundwater is greatly impacted by the careless and inappropriate discharge of industrial effluents that are enriched in different chemical, organic, inorganic and biological contaminants.The analytical procedure used to determine various physicochemical characteristics includes total hardness, total alkalinity, Chemical Oxygen Demand and Biological Oxygen Demandfor samples of ground water from fortydifferent sites of Sawai Madhapur district.The hardness of the reservoir water test locations was found to increase as the monsoon season transitioned into the post-monsoon.High value of alkalinity in monsoon and post monsoon may be due to the agricultural runoff with rain water.The concentration of COD in all the samples was lower in the pre-monsoon season but higher in the rainy season and further decreases in post-monsoon season.The BOD levels were lower during the pre-monsoon season at every sample location. The influx of organic waste and increased bacterial activity during the monsoon season resulted in the highest BOD value.
Keywords: Hydrochemistry, Chemical Oxygen Demand and Biological Oxygen Demand.

I. INTRODUCTION

India and other developing nations have a high demand on natural resources, particularly water, which is scarce and must be preserved for coming generations. Groundwater suitability for drinking and other purposes mainly depends on the types of ion and their concentration present in it[1-2].In the Indian subcontinent, the strain on groundwater resources has multiplied due to industrialisation and the green revolution.Rajasthan, the largest Indian state, is predominately arid and semi-arid, where groundwater provides approximately 90 % of drinking water and 70 % of irrigation water requirements. The contamination of groundwater in Rajasthan has been highlighted by the Central Ground Water Board CGWB (2021), India.

The hydrochemistry of groundwater is greatly impacted by the careless and inappropriate discharge of industrial effluents that are enriched in different chemical, organic, inorganic and biological contaminants[3].According to WHO reports from 2004, drinking water contamination is the cause of 80% of illnesses worldwide. A possible check on the presence of pollutant in drinking water is needed for the betterment of health.Excessive groundwater abstraction for irrigation and irrigation return flow (IRF), a substantial source of groundwater recharge, particularly in agriculturally dominant regions; have also been found to significantly affect the ion concentration in groundwater[4-5].

According to studies, approximately 66 million people in India suffer from skeletal and dental fluorosis as a result of fluoride (F^-) contamination in groundwater, with the most severely impacted regions including states such as Telangana, Gujarat, Andhra Pradesh and Rajasthan.In India, more than 108.2 million people are exposed to nitrate concentrations exceeding the permissible limit. Prolonged exposure to elevated nitrate levels possesses severe health risks, such as Methemoglobinemia (Blue baby syndrome) in infants and it increases the vulnerability of adults to thyroid dysfunction, hypertension and stomach cancer[6-7].

II. MARTIALS AND METHODOLOGY

Study Area-

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.

The analytical procedure used to determine various physicochemical characteristics for samples of ground water from different sites of Sawai Madhapur district.Total forty study sites were identified as Sawai Madhopur (Sample 1-5), Gangapur City (Sample 6-10), Malarna Doongar (Sample 11-15), Khandar (Sample 16-20), Wazirpur (Sample 21-25), Chauth Ka Barwada (Sample 26-30), Bonli (Sample 31-35) and Bamanwasv (Sample 36-40).The physical parameter includes total hardness, total alkalinity, Chemical Oxygen Demand and Biological Oxygen Demand comprises the various types of chemical constituent present in water in different seasons according to APHA protocol.

S. No.	Physicochemical Characters	Methodology
1.	Total Hardness	Total hardness was determined by EDTA titrimetric method. This method depends on ability of ethylene diamine tetra acetic acid or its disodium salt to form stable complexes with calcium and magnesium ions.
2.	Total Alkalinity (TA)	For the determination of TA, the water samples were titrated against standard acid using phenolphthalein and methyl orange as indicators.
3.	Chemical Oxygen Demand (COD)	In this method, the sample is refluxed with a known volume of potassium dichromate in sulphuric acid medium and excess dichromate is titrated against Ferrous Ammonium Sulphate by using Open reflux method.
4.	BOD (Biological Oxygen Demand)	BOD was determined by incubating the water samples at 27· C for 5 days in BOD incubator and calculating the DO on third day. BOD was then estimated by deducting the final DO with the initial DO.

III. OBSERVATION AND DISCUSSION

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. Hard water has high concentration of Ca^{2+} and Mg^{2+} ions.The high hardness rating and the river's sewage contamination are shown to be clearly correlated[8]. Ca^{2+} and Mg^{2+} measurements of water hardness indicate water quality rather than pollution.

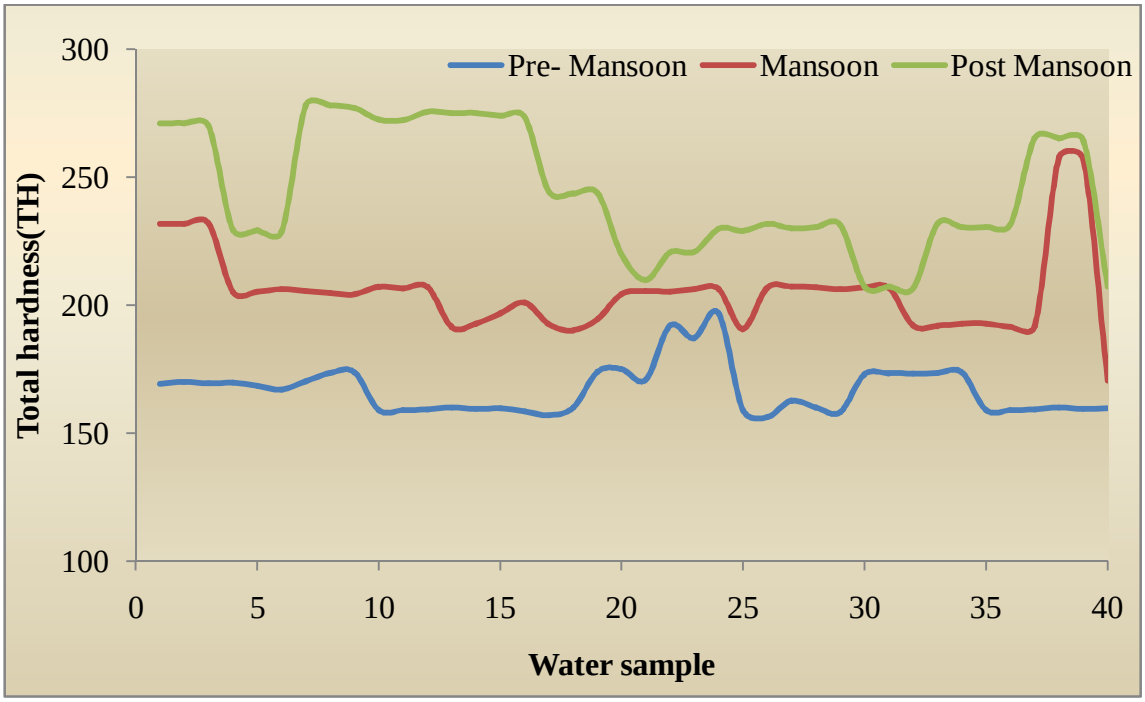

Fig-1. Total hardness (TH) of 40 water sample at various sites during pre-monsoon, monsoon and post-monsoon season.

Our research indicates that the pre-monsoon average groundwater total hardness value is 166.932 mg/l, whereas the monsoon and post-monsoon averages are 205.059 mg/l and 244.547 mg/l, respectively. The hardness of the reservoir water test locations was found to increase as the monsoon season transitioned into the post-monsoon.

Alkalinity helpstobuffer pH changesandisthusimportantfor aquatic organisms.Natural alkalinity mostly comes from hydroxides, carbonates and bicarbonates. Bicarbonates are created in the soil when carbon dioxide combines with calcium or magnesium carbonate.

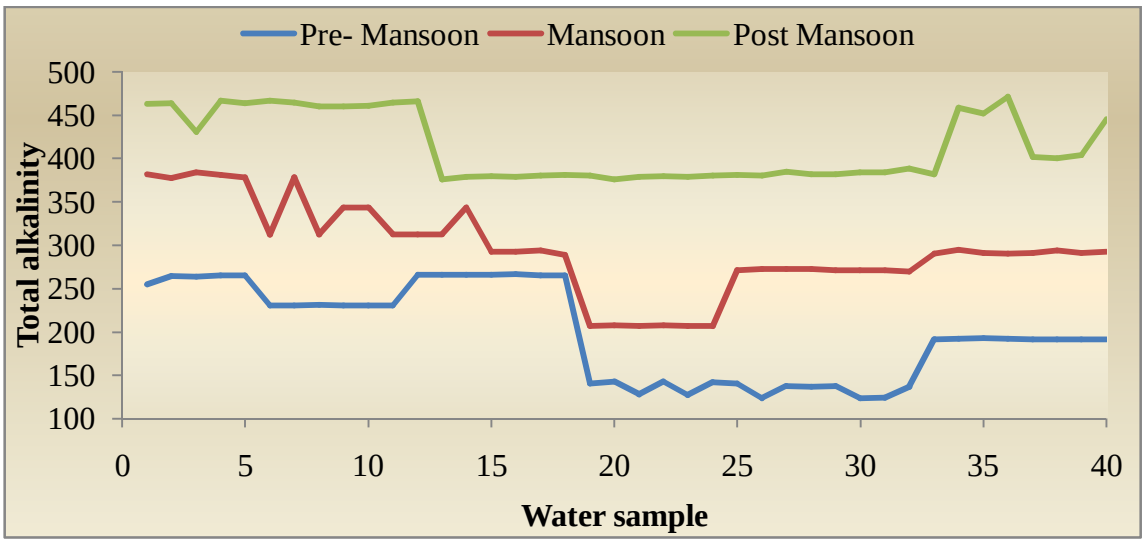

Fig- 2 Total alkalinity of 40 water sample at various sites during pre-monsoon, monsoon and post-monsoon season.

In our finding, average total alkalinity of ground water is 199.227mg/l, in pre monsoon whereas average total alkalinity value in monsoon and post monsoon is 294.669mg/land 414.024mg/lrespectively.High value of alkalinity in monsoon and post monsoon may be due to the agricultural runoff with rain water from adjacent agricultural land having fertilizers, pesticides and manure[9]. As season changes from monsoon to post monsoon, increase in alkalinity of reservoir water was observed.

The chemical oxygen demand displays the oxygen equivalent of organic and inorganic compounds that can be oxidised with a strong oxidising agent. It is an indirect measure of the amount of organic and inorganic pollution in waste water and is commonly used to evaluate the quantity of water[10].

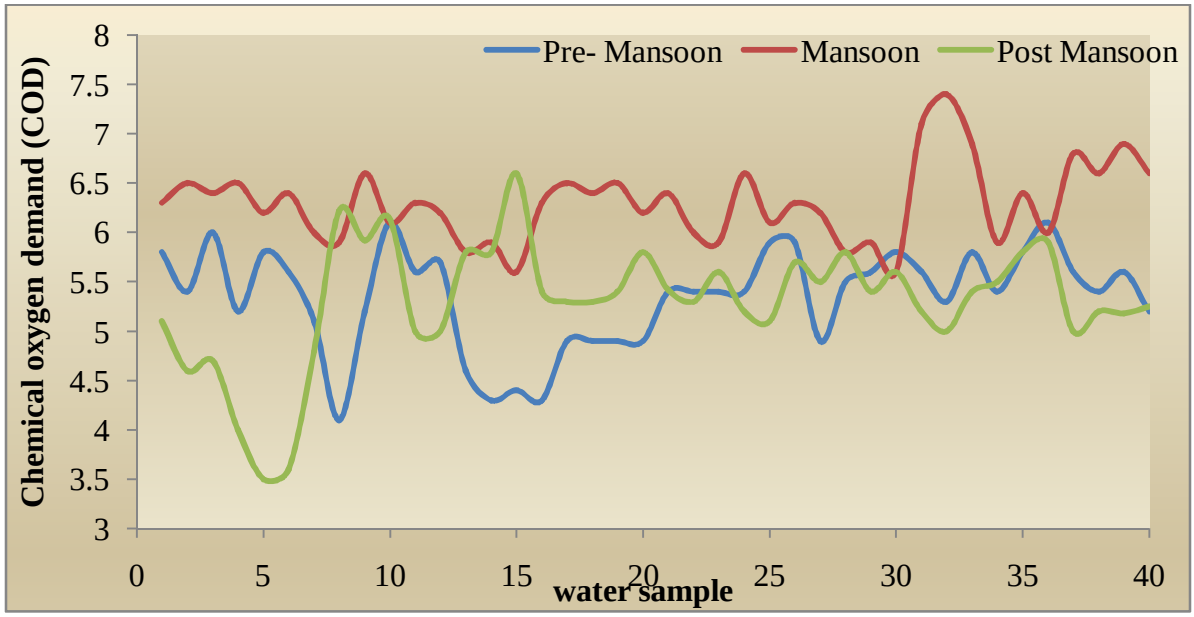

Fig- 3 Chemical oxygen demand (COD) value of 40 water sample at various sites during pre-monsoon, monsoon and post-monsoon season.

In our finding, average COD value of ground water is 5.345 mg/l, in pre monsoon whereas average COD value in monsoon and post monsoon is 6.300 mg/land 5.300mg/lrespectively.The concentration of COD in all the samples was lower in the pre-monsoon season but higher in the rainy season and further decreases in post-monsoon season. This may be due to introduction of chemical waste materials along with microbial contamination in water along with rain water which decreases in post-monsoon season.

Unpolluted streams typically have a BOD value of 2.00 mg/l and waste water, whereas receiving rivers have a BOD value of 10.00 mg/l. The high BOD value indicates that there is a considerable quantity of bio-oxidizable organic matter in the water.In our finding, average BOD value of ground water is 4.840 mg/l, in pre monsoon whereas average BOD value in monsoon and post monsoon is 5.415 mg/land 5.0375mg/lrespectively.The BOD levels were lower during the pre-monsoon season at every sample location. This might be because there is less microbial growth and organic matter inversion, although both of these are higher during the rainy season, which raises the BOD of the water.

The influx of organic waste and increased bacterial activity during the monsoon season resulted in the highest BOD value. The elevated BOD during the monsoon season might also be caused by the presence of many microorganisms in water bodies[3-4].

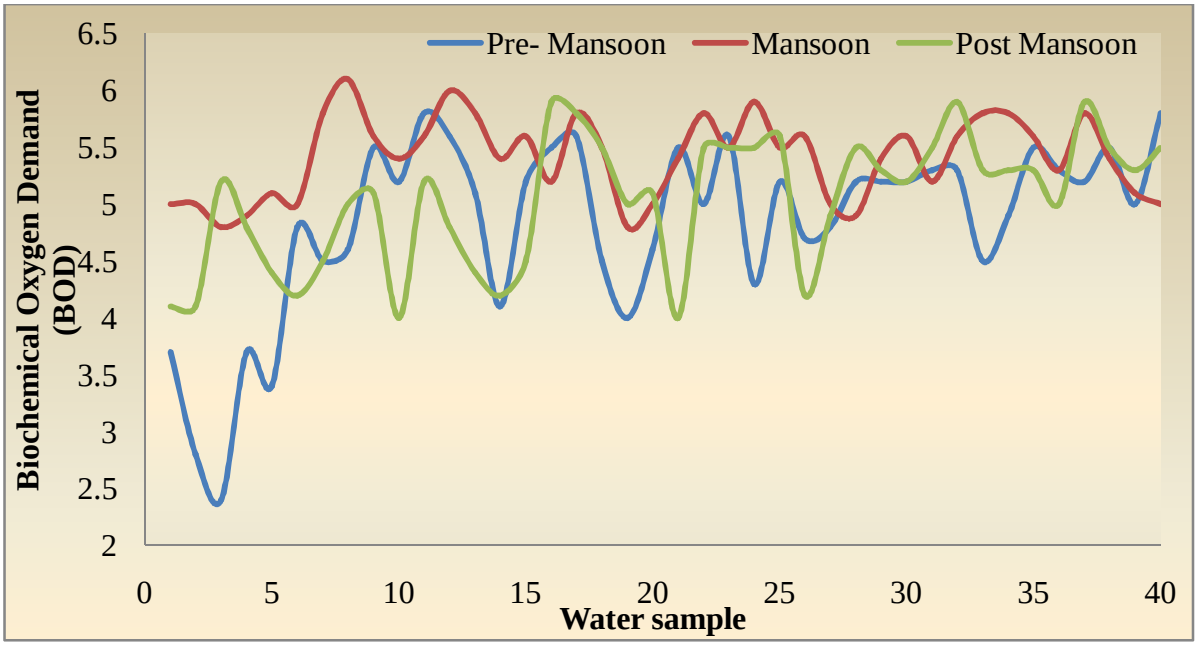

Fig- 4 Biochemical Oxygen Demand (BOD) value of 40 water sample at various sites during pre-monsoon, monsoon and post-monsoon season.

IV. CONCLUSION

This study aims to improve understanding of the local water quality, identify feasible approaches, and offer recommendations for addressing the issue of groundwater pollution. To maintain the safe and sustainable use of the water supply, it is crucial to comprehend the scope and causes of groundwater pollution.Provided information to local populations on the levels of microbiological and groundwater pollution as well as the existing techniques for preventing the spread of water-borne illnesses.

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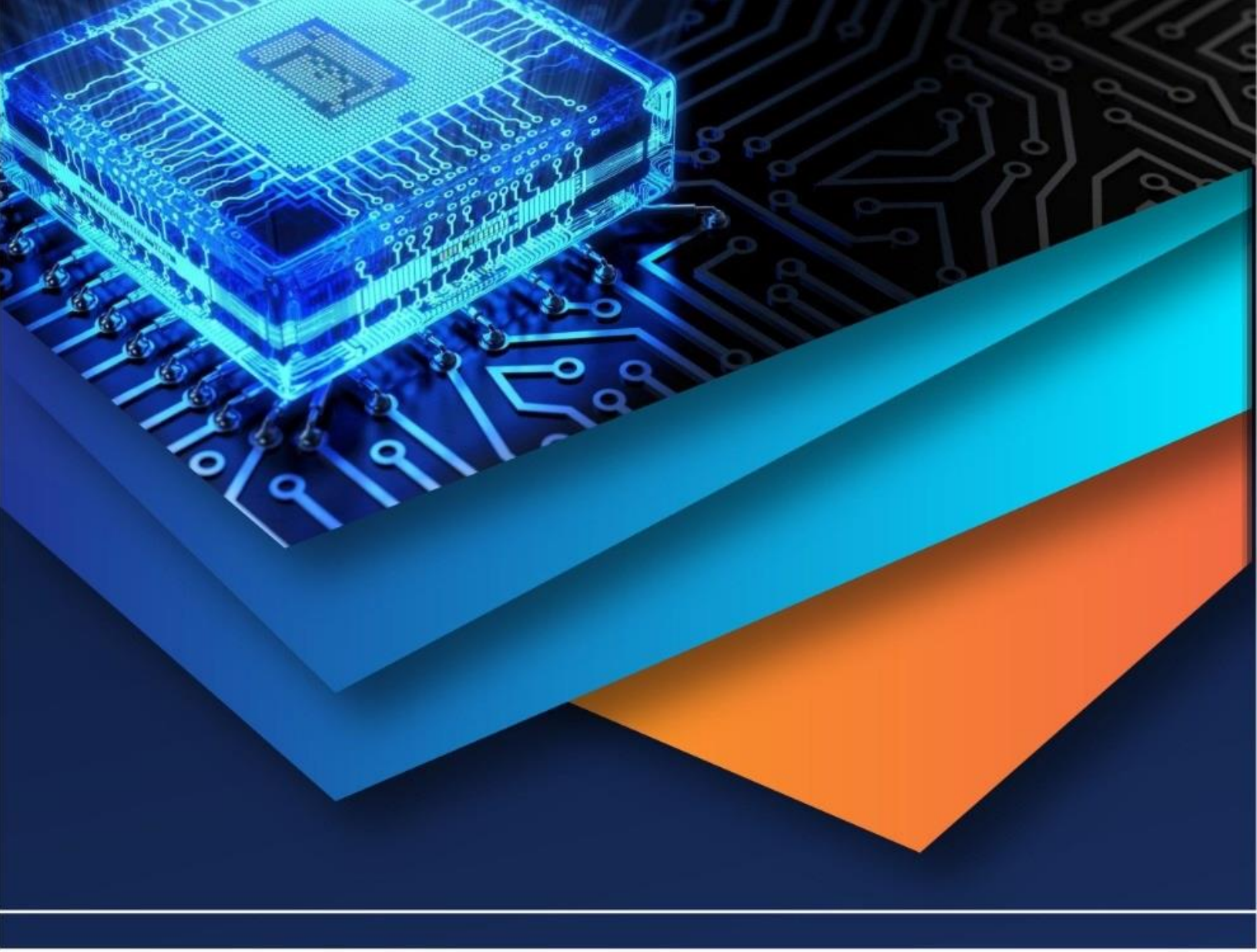

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