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Groundwater Analysis of Dausa City to Assess It's Quality

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ABSTRACT: Assessment of water pollution in a rural area is often not taken on priority as compared to urban areas. However, rural activities such as bathing, washing etc in vicinity of water sources can lead to contamination of water. Assessment of water quality in such cases at regular interval is necessary in order to minimise the impact of water pollution. In this study, groundwater quality of Dausa in the state of Rajasthan, India has been assessed through application of Weighted Arithmetic Water Quality Index (WAWQI) and Council Ministers of Environment Water Quality Index (CMEWQI). Water from 50 groundwater sources from 9 villages had been used to assess the quality nearby and in Dausa City. The parameters such as pH, Turbidity, TDS, Total Hardness, Total Alkalinity, Dissolved Oxygen, and Chloride were analysed in these groundwater sources consecutive six months. WAWQI, and CMEWQI were calculated for each water source and the reference standards used for the comparative assessment of the parameters were IS, WHO and CPCB. Assessment using WAWQI, revealed that 46% of the sources were found to be of good water quality, while using CMEWQI, 54% of the sources were found to be of marginal water quality. Majorly exceeding parameters were Total Hardness, Total Alkalinity, TDS, and Turbidity. Treatment of these parameters with appropriate conventional strategies can make the groundwater safe for drinking purposes. This study sheds light on the pristine condition of the groundwater quality in the rural environment and thus is appropriate for water quality assessment in different rural villages nearby Dausa City and the Dausa City itself.

KEYWORDS: water pollution, quality, Dausa, groundwater, parameters, analysis, assessment, safe

I.INTRODUCTION

Water is one of the most important substances on earth. All plants and animals must have water to survive. If there was no water there would be no life on earth. It is most important that the water which people drink and use for other purposes is clean water. The quality of water is of upper most importance compared to quantity in any water supply planning and especially for drinking purpose¹. The chemical, physical and bacterial characteristics of ground water determine its usefulness for municipal, commercial, industrial, agricultural, and domestic water supplies.

pH is the measure of the acidity or alkalinity of solution. A pH of 7 is neutral; lower number indicates acidity whereas higher indicates alkalinity. During present investigation, It was observed from the pH value that water samples were varying from 7.0 to 7.9. Lowest pH value is recorded in Dausa city² and the highest was found in nearby village near Gujarat. In general, pH of groundwater samples of the study area is within the permissible limit.³

The electrical conductivity at 25°C of water is due to the presence of various dissolved salts.

EC of the groundwater is varying from 687.5 to 3162.5 S/cm at 25°C.⁴

A high total dissolved solid (TDS) reduces utility of water for drinking, irrigation and industrial purposes. ⁴TDS varied from 412.5 to 1739 mg/L. According to Indian standards, 94.5% of the samples has exceeds the permissible limit and 5.5% of samples are within the permissible limit.

Higher value of TDS can be attributed to the contribution of salts from the subsurface lithology and further due higher residence time of groundwater in contact with the aquifer [2,3,4].

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The chloride (Cl⁻) concentration varies between 72 to 367 mg/l. From the results, it is observed that in 16% samples chloride content is higher than permissible limit (250 mg/l). High concentration of chloride in drinking water gives a salty taste to the water and produces a laxative effect on people not habituated to it. Moderate quantities have little effect on the usefulness of water for most purposes.⁵

The hardness of water is define as the soap consuming capacity of water. It is determined by the concentration of multivalent cations in water .Its permissible limit is 300 mg/l. From the results, it is observed that Hardness content is higher than permissible limit in 44 % samples.

The Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye. From the results, it is observed that all the water samples are within the permissible limit.⁶

From the investigation, it has been concluded that excess concentration of chloride, EC and TDS as well as the presence of water hardness, make the groundwater unfit for drinking.

II.DISCUSSION

Groundwater quality in India's desert state Rajasthan, Dausa City is hit by the simultaneous presence of both human-made pollutants and naturally occurring toxic minerals, a study has shown. The spoiled groundwater is unsafe for drinking without treatment, warn researchers. The researchers tested 24 groundwater wells, across the Dausa to probe the presence of multiple contaminants in groundwater. They discovered that over three-quarters of the wells (tubewells or handpumps), that provide drinking water without any treatment, contains contaminants such as fluoride, nitrate,⁷ and uranium at levels that exceed both Indian and World Health Organisation (WHO) drinking water norms. A combination of geogenic (natural or geologic) and anthropogenic (or man-made) processes affect groundwater chemistry and quality in Dausa. "Man-made contaminants such as those that leach out from agriculture and domestic sewage (for example pathogens, nitrates) keep authorities on their toes. The geogenic contaminants such as those coming from aquifer rocks (fluoride and uranium) can go unnoticed because they are considered natural and their health effects are not immediately detected. Consumption of drinking water contaminated with uranium can cause chronic kidney disease and deformity of bones.⁸ Additionally, fluorosis related to fluoride intake has been described in Dausa city of Rajasthan. "The fact that so much of the state is reliant on groundwater makes the situation more concerning. Anthropogenic pollution factors include over-pumping and pollution from wastewater. Human activities, such as water use for agriculture, and landscape changes can also enhance these natural processes. Complicating the issue is the fact that human-made pollutants may feed into geological processes, worsening the release of natural contaminants trapped in aquifer rocks.⁹

In looking at multiple contaminants and laying out the routes for contamination of groundwater, the researchers also flag the possibility of finding a special category of emergent pollutants called disinfection byproducts (DBPs) in treated (chlorinated) water in Dausa. DBPs form when the chemicals used to treat water (such as chlorine) react with naturally-occurring materials in the water to form compounds that may pose health risks. The basis for the experts' concern is the presence of high concentrations of dissolved organic carbon (DOC), nitrates and halides in the sampled groundwater that can increase the likelihood of formation of DBPs in waters that are treated with chemical disinfectants such as chlorine. The study calls for evaluation and monitoring of these emerging pollutants.¹⁰ The concentrations of DBPs such as combined trihalomethane compounds (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) are regulated in some municipalities but information on them and other DBPs' is not publicly available. "Given the concentrations of halogens and DOC we found in many of the investigated groundwater in Dausa and the evidence for wastewater contamination reported in this study, DBPs should be an important point of consideration for future water studies and water management in Dausa. Dausa suffers from severe water scarcity issues due to a combination of over-exploitation and climate effects. Along with concerns over water availability, endemic water quality issues are critical and affect the usability of available water and potential human health risks, the study states.¹¹

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III.RESULTS

Multivariate analysis can be successfully used to determine the dominating constituents, which control the groundwater quality of a region. The ground water quality data of Dausa city in Rajasthan was grouped as shallow aquifers (< 40 m depth) and deep aquifers (> 40 m depth). Principal Component Analysis was used to predict the dominating water quality constituents and it revealed that five principal components are accounted for the total chemical variability in the ground water quality of both aquifers. The common constituents-fluoride, nitrate, pH and potassium have perceptible influence on the quality of ground water of both aquifers of Dausa city in Rajasthan. Several parts of the city, especially Dausa, is facing an acute shortage of water. The number of hand pumps in the area is low compared to the population but even these are dry as the groundwater level has gone down¹². As it is a hilly tract, the water here is hard and contain fluoride. The falling water table due to overextraction from ground aquifers and pollution of the water bodies due to agricultural, urban and industrial wastes has posed a never ending threat to groundwater. Thus, measures are needed to be taken to resolve the groundwater problems as depletion of water table and deterioration in groundwater quality are the critical issues. It is clear that there is an acute shortage of water, thus, creating a tremendous pressure on the fragile water resources due to high population growth and overconsumption, finally leading to the deterioration of quality and quantity of water.¹³ Some samples showed high content of TDS, fluoride, nitrate, bicarbonate, etc. along with high variability, which is a matter of great concern. As water resources are limited and the demand continues to rise steeply, it calls for an urgent need of an efficient planning and implementation of programmes of water resources appraisal, development, conservation and management in Dausa City.¹⁴

IV.CONCLUSIONS

Groundwater management practices need to take hydrogeology, the agro-climate and demand for groundwater into account. Since agroclimatic zones have already been demarcated by the Government of India, it would aid policy makers to understand the status of groundwater recharge and discharge in each agroclimatic zone. However, developing effective policies to manage groundwater at agroclimatic zone and state levels is constrained due to a paucity of temporal data and information. With the launch of the Gravity Recovery and Climate Experiment (GRACE) mission in 2002, it is now possible to obtain frequent data at broad spatial scales and use it to examine past trends in rain induced recharge and groundwater use. In this study, the GRACE data were used to estimate changes to monthly total water storage (TWS) and groundwater storage in different agroclimatic zones in Dausa city, Rajasthan. Furthermore, the long-term annual and seasonal groundwater storage trends in the state were estimated using the GRACE data and the trends were compared with those in rainfall data. The methodology based on GRACE data was found to be useful in detecting large scale trends in groundwater storage changes covering different agroclimatic zones. The analysis of data shows that groundwater storage trends depend on rainfall in previous years and, therefore, on the antecedent moisture conditions. Overall, the study indicates that if suitable groundwater recharge methods and sites are identified for the state, there is potential to achieve more groundwater recharge than what is currently occurring and, thus, enhancing the availability of water for irrigated agriculture.¹⁵

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