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Quality of Groundwater Investigated During the Pre-Monsoon Season in Masuda Tehsil of Ajmer District in Rajasthan

Kishan Gopal Jhanwar, Rajeev Mehta & Preeti Mehta

Department of Chemistry, Sangam University, Bhilwara, Rajasthan, India

EMAIL: kishangopaljhanwar62@gmail.com

ABSTRACT: Water of good drinking quality is of basic importance to physiology and man's continued existence depends very much on its availability. This study is done to understand the physiochemical parameters of the groundwater of different sites of Masuda Tehsil of Ajmer district, Rajasthan using statistical tools. To carry out the research Groundwater samples were collected for pre monsoon period of this year, 2021. For quality assessment, values of analysed parameters of the groundwater samples were compared with the Bureau of Indian standards (BIS) and World Health Organization (WHO) water quality standards. The analytical results indicate slightly acidic to slightly alkaline nature of the groundwater in the study area. Water samples were collected from each site and chemical analysis was conducted. With the help of one-way ANOVA test the difference between the three sites based on the parameters was calculated. This paper revealed that groundwater of different sites in Masuda tehsil showed variations in all eleven parameters using statistical methods like paired t-test and Analysis of Variance (ANOVA) tests. The groundwater of all the sites is not suitable for drinking & industrial purposes which will help the local government to take necessary action. The GIS-based WQI maps for the study area indicate that the poor quality of water was found the maximum in the pre-monsoon season. Water is not suitable for direct consumptions and it required sustainable treatment before its utilization for drinking uses.

I. INTRODUCTION

Groundwater is emerging as a critical issue for cities and towns around the world. It is estimated that approximately one-third of the world's population use groundwater for drinking uses. In India, the accessibility of surface water is more than groundwater. But, owing to the decentralized availability of groundwater, it is easily accessible and forms the largest part of India's agriculture and drinking water supply. Domestic water requirements are fulfilled by groundwater about 50% of urban water requirement and 85% of rural domestic requirements. However, in recent times, India is fast moving towards a crisis of groundwater overuse and contamination.[1] The rapid increase in population, the growth of industrialization, the use of agricultural chemicals and the disposal of urban and industrial waste have all played a major role in groundwater contamination and increased tremendously the pressure on water resources . Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source, and therefore, it becomes very important to regularly monitor the quality of groundwater and to devise ways and means to protect it. Water pollution not only affects water quality, but also threats human health, economic development and social prosperity . Scarcity of clean and potable drinking water has emerged in recent years as one of the most serious developmental issues in many parts of Rajasthan.[2] Water quality index (WQI) method is a technique of rating water quality and an effective tool to express water quality that offers a simple, stable, reproducible unit of measure and communicate information on the quality of water to the concerned citizens and policy-makers. The quality of water is a major issue due to the public ignorance to environmental considerations, lack of provisional basic social services, indiscriminate disposal of increasing anthropogenic and mining wastes and discharges of improperly treated sewage/industrial effluents, resulting in excess accumulation of pollutants on the land surface and contamination of available water resources .[3]

II. STUDY AREA

Masuda is a Tehsil / Block (CD) in the Ajmer District of Rajasthan. According to Census 2011 information the sub-district code of Masuda block is 00610. Total area of Masuda is 875 km² including 856.90 km² rural area and 17.89 km² urban area. Masuda has a population of 2,24,181 peoples. There are 43,609 houses in the sub-district. There are about 148 villages in Masuda block. Hydrogeology of the study groundwater sample, groundwater is mainly replenished by the atmospheric precipitation and its condition is very complicated due to the wide variety of sand.

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III. MATERIALS AND METHODS

In the laboratory, the water samples were filtered through 0.45-µm Millipore membrane filters to separate suspended particles. The pH and EC of water samples were measured in the field immediately after the collection of the samples by using Multiparameter probe (PCSTestr 35). Major cations (Ca^{2+}, Na^{+}, and K^{+}) were analysed by using Systronics Flame Photometer 128. Magnesium, TH, bicarbonate and chloride were estimated by a titrimetric method using standard EDTA, HCl and $AgNO_3$ as titration solution. Sulphate, fluoride and nitrate were estimated by using the UV–Vis spectrophotometer. Calculated ionic balance error was found within the permissible limit of ± 10%, and the ratio of TDS/EC is within acceptable limits (0.8) for confirming the reliability of the analytical results.

IV. DISCUSSION

Water quality index (WQI) was used for evaluating the composite influence of individual water quality parameter on the overall quality of water . WQI is a mathematical equation used to summarize a large number of water quality data into a single number and understandable format. In assessing the suitability of drinking water, the water quality data of the analysed samples were compared with the recommended drinking water standard of BIS . In computing WQI, three steps are followed. In the first step, each of the 13 parameters (pH, TDS, F^{-}, Cl^{-}, NO_3^{-}, SO_4^{2-}, HCO_3^{-}, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, TH) has been allotted a weight (w_i) according to its relative importance in the overall quality of water for drinking purposes. The maximum weight of 5 has been allotted to the parameters like TDS, F^{-}, Cl^{-} and NO_3^{-} owing to main significance in water quality assessment .[4] HCO_3^{-} and TH are given the minimum weight of 1 and 2 assigned. Other parameters like Ca^{2+}, Mg^{2+}, Na^{+} and HCO_3^{-} were assigned a weight (W_i) between 3 and 4 depending on their importance in water quality determination. In the second step, the relative weight (W_i) is computed from the following equation as it plays an insignificant role in the water quality assessment.[15]

$Wi = Wi / \sum ni\ Wi$

where the W_i is the relative weight, W_i is the weight of each parameter and n is the number of parameters. (Table-1 and Table-2)

Table 1 : Relative weight of chemical parameters

Parameters	Weight (w_i)	Relative weight ($W_i = k/S_i$)	BIS (IS:10500) (2012)
pH	4	0.108	6.5–8.5
TDS (mg/L)	5	0.135	500
Total hardness (mg/L)	2	0.054	200
F^{-} (mg/L)	5	0.135	1.0
Cl^{-} (mg/L)	5	0.135	250
NO_3^{-} (mg/L)	5	0.108	45
SO_4^{2-}(mg/L)	4	0.108	200
HCO_3^{-} (mg/L)	1	0.081	200
Ca^{2+} (mg/L)	3	0.081	75
Mg^{2+} (mg/L)	3	0.081	30
	$w_i = 37$	$W_i = 1.0$	

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Table 2: Classification of WQI range and category of water

WQI	Status
< 50	Excellent water
50–100	Good water
100–200	Poor water
200–300	Very poor water
> 300	Unfit for drinking purpose

Water is one of the most important natural resource available to mankind. Knowing the importance of water for sustenance of life, the need for conservation of water bodies especially the fresh water bodies is being realized everywhere in the world. This need has added significance, especially in the water stressed region such as Rajasthan. [5]

V. RESULTS

Table 3: Physico-chemical characteristics during pre-monsoon period in Masuda tehsil

SN	PARAMETERS	Site-1	Site-2	Site-3	Site-4
1	Atmospheric temperature	30C	35C	32C	31C
2	pH	8.5	8.0	7.5	7-8.5
3	Alkalinity	460mg/l	340 mg/l	100 mg/l	120 mg/l
4	Hardness	120mg/l	106 mg/l	70 mg/l	300 mg/l
5	Dissolved oxygen	4.2mg/l	5.2mg/l	6.5mg/l	5.0mg/l
	Chloride	63.9mg/l	71.0mg/l	21.3mg/ l	20mg/l

pH

pH is one of the very factors that serve as an index for the pollution. The average pH ranged from 7.5 to 8.5. The alkaline nature of water due to high pH values can be attributed to high productivity of water as evidenced by high growth rate of algal population which utilized CO2 through photosynthetic activity. The ideal pH range is 6.7 to 8.4 while pH below 5.0 and above 8.3 is detrimental. [14]

Total Alkalinity

The total alkalinity at the 3 sites fluctuated between 100-460 mg/l indicating that the water is hard. high alkalinity indicates pollution. Excessive alkalinity may cause eye irritation in humans and chlorosis- in plants. Alkalinity itself is not harmful to human beings; still water supply with less than 100 mg/l of alkalinity is desirable for domestic use. According to USPHA maximum permissible is 120 mg/l.[6,13]

Total Hardness

The average total hardness value ranged from 70 mg/l to 120 mg/l. classified water on the basis of hardness values in the following manner; 0-60 mg/l, soft 61-120 mg/l, moderately hard 121-160 mg/l, hard and greater than 180 mg/l very hard. The hardness at the 3 sites was within the permissible limits. Hardness below 300 mg/l is considered potable but beyond this limits cause gastro-intestinal irritation Normal water hardness does not pose any direct health problems. addition of sewage, detergents and large scale human use might cause elevation of hardness of water.[7,12]

Chloride

The average chloride values ranged from 21.3 mg/l to 63.9 mg/l. The increased concentration of chloride is considered as an indicator of eutrophication and pollution due to sewage .The chloride in the 3 sites was within the acceptable limit of 20 mg/l. In natural surface water the concentration of chloride is normally low.[8,11]

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Dissolved Oxygen (DO)

The values of dissolved oxygen varied from 4.2 mg/l to 6.50 mg/l. This can be due to higher rate of decomposition of organic matter and limited flow of water, leading to consumption of O2 from water The presence of DO in water may be due to direct diffusion from air and photosynthetic activity of autotrophs. The addition of a variety of biodegradable pollutants from domestic and industrial sources stimulates the growth of micro organisms; which consume the DO of the water. DO is a good indicator of water quality and its relation to the distribution and abundance of various algal species along with the degree of pollution by organic matter and level of self purification of water.[9,10]

VI. CONCLUSION

From the present investigation, it emerges that water of Masuda tehsil is most polluted having high alkalinity, free CO2 , hardness and ph but a low level of DO, endosulfan and zinc contents in Masuda tehsil are also high, thus making it unsuitable for biota and fish . Data from the Fisheries' Department, Government of Rajasthan, substantiate these observations, since the variety observed in fish fauna and percentage catch of *Catla catla* of Masuda tehsil water is low . Pollution is taking its toll. Some species (*Cyrrinus mrigila, Clarius batrachus*, etc.) Netted three years back in Masuda tehsil ponds are now practically missing from the catch (F.D., Govt. of Rajasthan). It is time for public awareness and stringent government regulations.[16]

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