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RESEARCH ARTICLE

CORROSIVITY OF GROUNDWATER SAMPLE OF MANDOLI VILLAGE OF NEEMKATHANA BLOCK OF SIKAR, INDIA

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ABSTRACT

Rajasthan is desert state in India and the most of population is depends on the groundwater. The average annual rainfall is 580 mm with 30 rainy days. Groundwater level is in range of 250 feet to 400 feet. The level of groundwater is going down due to the growing population and per capita increase of consumption by urban and rural area.The testing and monitoring of water is very important and the water impurities are time varying parameter and it is also affected by the use of chemicals in agriculture, mining activities and industrialization. In the present study corrosivity of water is selected for the determination of suitability of source for drinking purposes.

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INTRODUCTION

According to Sargaonkar and Deshpande (2003) work of assessment of water quality and pollution control is conducting by different National and International Agencies for various uses of water, for this purpose they are considering different indicator parameters. These classification schemes differs in terminologies used like Action level/ Guide level for the determination of water quality standards. Copper and lead leach out due to the too low hardness of drinking water and low level of beneficial ions, while too high hardness can give the unpleasant test, dry out the skin and scaling (SDWF. (n. d.).USGS (2019) stated that many factors contribute to the corrosive nature of water such as pH being out of range, lower alkalinity, and elevated concentration of Total solid (TDS and TSS).High acidity in water will induce high corrosivitytendencies on metallic water storage and distribution facilities (Sajil Kumar 2019). The integration of multiple storability and corrosivity evaluation indices of groundwater samples have more corrosive tendencies than scaling, and result may expose domestic, industrial, municipals, and agricultural water distribution and storage facilities to a high risk of corrosion (Omeka *et al.,* 2022). For the stability assessment of water Ryznar (1944 proposed, Ryznar stability index (RSI), which is also been found very useful in water distribution systems to know predictive model for corrosivity and scaling tendency.

Elevatedcorrosivity observed is majorly due to the lowp H of the water (Agatemor & Okolo2008).The water level data collected by the NHS during 2018-2019 has been used showing the depth and fluctuation of the water level in the state. It is observed that in Sikar district the water level depth is constantly more than 40 mbgl for the whole year. Neemkathana area under the Sikar district is also found the same situations of water level depth more than 40 mbgl (Ground Water Year Book 2019-20 Rajasthan).Anthropogenic, geogenic contamination are assumed to be responsible for degradation of quality of water. If the groundwater gets contaminated by pollutants, than the quality of groundwater cannot be restored, if we try to stop the pollutants to further add from the source therefore, it is very important to monitor regularly groundwater, and to find the possible techniques to maintain its quality (Ramakrishnaiah *et al.*, 2009).Mining also affects the level of the water table, a continuous lowering reported due to mining activities (Karmakar& Das, 2012). Neemkathana block of Sikar district is semi-arid in nature with low annual rainfall, this block is rich in minerals due to the large area of sedimentary and metamorphic rocks, a part of Aravalli hills. Mining of rock needs a large number of explosive materials which are itself hazardous to health, and mining activities are going on below the water table. Fine particles and explosives at mining sites continuously enter into the aquifer system with groundwater recharging, and with the runoff up to the nearby surface-water reservoir. Shallow aquifer quality is more affected by the increased mining activities.

Study Area

Geographic Location: GPS coordinates for Neemkathana is 27° 44' 16.8036" N and 75° 46' 58.7892" E with hydrological formation is older alluvium and quartzite and principal aquifer in the area is quaternary sediments.

METHODOLOGY

Corrosive tendency of water can be calculated by so many methods like Larson-Skold index (LSI), Chloride-sulfatemass ratio(CSMR), Langelier index (LI), Puckoriusscaling index(PSI), Ryznarstability index (RSI), Aggressive index (AI) etc. in present study Aggressive index (AI) method is used for the assessment of corrosivity.

(source: https://www.safewater.org)

Figure 1.5. Scale deposition into water supply pipes

Aggressive Index: American Water Works Association (AWWA) developed the Aggressive Index as a part of Standard C-400, which indicates the corrosive tendency of water (Trenchless Pedia, n. d.). AI = pH + log (A x H) Where A is Total alkalinity and H is the total hardness of water

RESULT AND DISCUSSION

Assessment of groundwater of Mandoli village in Neemkathana block: Table 2 includes the testing results of groundwater in Mandoli village for selected parameters, for the assessment period of Aug.-2020 to July-2021.

Table 1. Water level in different districts in Rajasthan

S.No.	Water level	Locations
1.	Water level more than 40 mbgl	Sikar, Churu Jaipur, Nagaur, Jalore, Bikaner, Jodhpur, Jaisalmer Dausa, Alwar,Jhunjhunu,
2.	Water level between 20-40 mbgl.	Hanumangarh, Dhaulpur, Bharatpur, Barmer, Chittorgarh and some places of Alwar, dausa, Bikaner & Jaisalmer
3.	Water level between 10 to 20 mbgl	Rajsamand, Sawaimadhopur, Sirohi, Bhilwara, Pratapgarh, Banswara, Chittorgarh, Ajmer, Karauli

(Source Ground Water Year Book 2019-20 Rajasthan)

Table 2. Aggressive Index value and class of groundwater

	Aggressive Index Value	Class of water
Aggressive index (AI)	AI>12	Scaling tendencies but non-aggressive
	$10 < AI < 12$	Moderately aggressive/corrosive
	AI< 10	Severally aggressive/corrosive

(Tavanpour et al. 2016; Abbasnia et al. 2018)

Parameter pH has no unit while all the selected parameters are shown in mg/L. For the assessment of the groundwater parameters, BIS (IS 10500:2012) is selected which have accepted, and permissible limits for each parameter, Aggressive index value more than 12, indicate, Scaling tendencies but non-aggressive, and moderately aggressive/corrosive less than 12. Sample of ground water collected from the sample site of Mandoli villageanalyzed and assessed for aggressive index value.

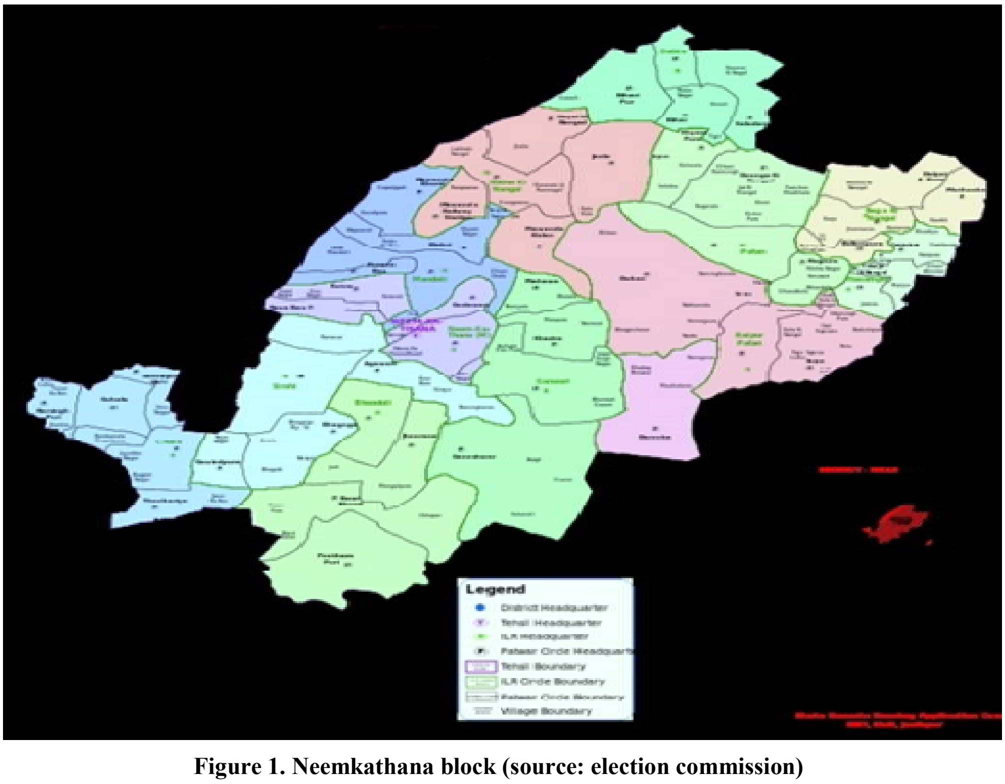

Figure 1. Neemkathana block (source: election commission)

. **Table 3. Water testing data of Mandoli village in Neemkathana**

Water testing of Mandoli Village in Neemkathana block			
Month	**P^H**	**Total Alkalinity, mg/L $CaCO_3$**	**Total Hardness, mg/L**
Aug-20	7.4	480	170
Sep-20	8	450	160
Oct-20	8.2	500	130
Nov-20	8.1	470	350
Dec-20	8.2	400	210
Jan-21	7.7	400	220
Feb-21	8.2	350	210
Mar-21	8.1	260	230
Apr-21	8.2	420	160
May-21	7.9	250	210
Jun-21	7.8	290	230
Jul-21	8	290	210

Table 4. Aggressive Index value for the assessment period

Month	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21
AI	12.31	12.86	13.01	13.32	13.12	12.64	13.07	12.88	13.03	12.62	12.62	12.78

CONCLUSION

For the determination of corrosivity in this study Aggressive Index method is used and AI values for the assessment period Aug-20 to July-21 are in the range of 12.31 to 13.32. The values more than 12 for groundwater samples indicates scaling tendencies but non-aggressive nature so the results states that the source of water is safe for drinking, domestic and industrial purposes. For 7 months, the value is near to 12 and continuous depletion of groundwater table and mining activities can further degrade the values so continuous monitoring of the groundwater sources is needed for the selected village.

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