CORRELATION AMONG PHYSICO-CHEMICAL PARAMETERS OF GROUNDWATER OF VILLAGE SALARPUR, RAJASTHAN, INDIA

Meenu[1*], Dr. Souvanik Talukdar[2], Dr. Meenakshi Sharma[3]

Abstract

Water that is present beneath the surface of land i.e. under the ground in the saturated zones is known as groundwater. A number of studies reveal that the water quality parameters are not as per permissible limits in various regions. The reasons of deteriorating water quality are both natural like rocks surrounding the under-ground water as well as anthropogenic such as improper sewage disposal and many more. The present study involves the analysis of various groundwater quality parameters such as pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total suspended solids (TSS), Dissolved oxygen (DO), Total hardness, Calcium hardness, Magnesium hardness, Total alkalinity, Salinity, Na^+, Ca^{2+}, Mg^{2+}, Cl^-, F^-, SO_4^{2-}, NO_3^-, HCO_3^-ions and total organic carbon (TOC). Correlation analysis among these parameters has been done. The study concludes thatthe groundwater of the study area is of saline nature.

Keywords: groundwater quality parameters, pH, Electrical conductivity (EC), Correlation analysis

[1*]Research Scholar, Department of Chemistry, SOBAS, Raffles University, Neemrana, Rajasthan, India
[2]Assistant professor, Department of Chemistry, K.L.P. College, Rewari
[2]Assistant Professor, Department of Chemistry, SOBAS, Raffles University, Neemrana, Rajasthan, India

[*]**Corresponding Author:** Meenu
[*]Research Scholar, Department of Chemistry, SOBAS, Raffles University, Neemrana, Rajasthan, India
E-mail: ghai.meenu@ymail.com

DOI: 10.53555/ecb/2022.11.6.36

Introduction

Water that is present beneath the surface of land i.e. under the ground in the saturated zones is known as groundwater. Water exists in the pores in the materials under the ground such as gravel, rocks etc. These rocks are known as aquifers, if the underground water is flowing naturally out of these rocks or can be pumped out in considerable quantity. The biggest issue regarding groundwater is deterioration of its quality. A number of studies reveal that the water quality parameters are not as per permissible limits in various regions. The reasons of deteriorating its quality are both natural, like rocks surrounding the under-ground water, as well as anthropogenic such as improper sewage disposal and many more. In a study it is revealed that groundwater samples from the studied area Iraq, were not suitable for drinking purposes but found to be of excellent type for livestock and poultry use [1].Another study suggests that excessive fluoride may lead to neurotoxicity, carcinogenicity, genotoxicity, thyroid dysfunction and fertility problems [2].Enrichment of fluoride in groundwater is largely controlled by the F^- containing minerals dissolution. Alkaline condition and calcium-removing processes promote water–rock interactions [3]. Concentration of Nitrate nitrogen was found to exceed the Japanese drinking water quality standards i.e.10 mg/l at fifteen locations. Nitrateion was strongly correlated with Chloride, Potassium, Sulphate, and Calcium ion. The livestock waste was responsible for high correlation with Cl^- and K^+. Chemical fertilizers and calcareous material were responsible for correlation with SO_4^{2-} and Ca^{2+} respectively [4].Coal mining is a big source of soil and water contamination [5]. During the analysis of physicochemical parameters of groundwater samples from RIICO Industrial area Bhiwadi (Alwar), it was found to have contaminants because of careless activities by industries. Toxic and carcinogenic chemicals were reported beyond limits in groundwater at few sampling sites. Ground water was reported as unsuitable for drinking and irrigation purpose [6]. Regarding correlation analysis, the physico-chemical parameters are correlated both positively and negatively among themselves [7].TDS is found to have the highest correlation with conductivity, sulphate, and chloride ion concentration whereas turbidity considerably correlates with nitrate in drinking water [8]. Another analysis showed significant linear relationship between pH, alkalinity, hardness, Ca^{2+} , Mg^{2+}, concentration of F^- and total solids [9]. A number of studies in Rajasthan report groundwater contamination [10]. This encouraged the author to study the ground water quality of Salarpur village as the study area is also surrounded by a number of industries.

Materials and methods

Study area chosen is Village Salarpur, Rajasthan, India. Sampling and analysis of groundwater samples was done as per APHA and IS.

Results and Discussion

Various groundwater quality parameters studied are pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total suspended solids (TSS), Dissolved oxygen (DO), Total hardness, Calcium hardness, Magnesium hardness, Total alkalinity, Salinity, Na^+, Ca^{2+}, Mg^{2+}, Cl^-, F^-, SO_4^{2-}, NO_3^-, HCO_3^-ions and total organic carbon (TOC).
Mean pH of groundwater samples reveals slightly alkaline nature of groundwater. Mean value of TDS, total hardness, total alkalinity is found to be above acceptable limits as per IS but below permissible limits.

Correlation analysis

Table 1 Correlation analysis of groundwater quality parameters of the study area

	pH (at 25°C)	*EC*	*TDS*	*TSS*	*DO*	*Total Hardness*	*Calcium Hardness*	*Magnesium Hardness*	*Total Alkalinity*	*Salinity*	*Na*	*Ca*	*Mg*	*Cl*	*F*	*SO4*	*NO3*	*HCO3*	*TOC*
pH (at 25°C)	1.000																		
EC	0.965	1.000																	
TDS	0.975	0.999	1.000																
TSS	0.942	0.876	0.886	1.000															
DO	-0.481	-0.655	-0.642	-0.384	1.000														
Total Hardness	0.846	0.950	0.938	0.686	-0.745	1.000													
Calcium Hardness	0.975	0.904	0.921	0.957	-0.445	0.734	1.000												
Magnesium Hardness	-0.058	0.182	0.143	-0.264	-0.484	0.473	-0.250	1.000											
Total Alkalinity	0.991	0.990	0.994	0.919	-0.556	0.905	0.943	0.067	1.000										
Salinity	0.965	1.000	0.999	0.866	-0.651	0.954	0.901	0.190	0.990	1.000									
Na	0.965	0.901	0.921	0.908	-0.480	0.753	0.990	-0.211	0.934	0.902	1.000								
Ca	0.948	0.998	0.995	0.854	-0.699	0.962	0.882	0.227	0.980	0.997	0.882	1.000							
Mg	0.331	0.528	0.500	0.066	-0.611	0.765	0.146	0.901	0.435	0.541	0.204	0.561	1.000						
Cl	0.986	0.991	0.993	0.927	-0.570	0.905	0.937	0.074	0.998	0.989	0.922	0.982	0.428	1.000					
F	0.974	0.934	0.945	0.978	-0.527	0.778	0.986	-0.170	0.959	0.928	0.963	0.919	0.192	0.962	1.000				
SO4	0.975	0.997	0.999	0.882	-0.651	0.935	0.926	0.132	0.992	0.997	0.929	0.993	0.495	0.990	0.946	1.000			
NO3	0.836	0.700	0.733	0.806	-0.257	0.496	0.921	-0.487	0.763	0.703	0.940	0.668	-0.070	0.742	0.849	0.748	1.000		
HCO3	0.592	0.738	0.726	0.554	-0.973	0.769	0.569	0.359	0.657	0.729	0.576	0.775	0.506	0.678	0.661	0.731	0.348	1.000	
TOC	0.913	0.853	0.873	0.917	-0.547	0.679	0.973	-0.294	0.880	0.848	0.970	0.840	0.078	0.878	0.965	0.884	0.919	0.661	1.000

According to Australian and New Zealand guidelines for fresh and marine water quality, the values of correlation coefficient 0.7 to 1.0 shows strong linear correlation. 0.5 to 0.7 means moderate linear correlation. 0.3 to 0.5 shows weak linear correlation. 0 to 0.3 suggests little or no linear correlation. Correlation among various water quality parameters is shown in Table 1.Dissolved oxygen is negatively correlated with almost all of the parameters. Nitrate and magnesium hardness are also moderately negatively correlated with each other. Most of the remaining parameters are linearly correlated to each other to different extents.

A number of parameters reveal correlation coefficient ≥ 0.99 i.e. very strong linear correlation such as-EC with TDS, total alkalinity, Sulphate, Calcium and Chloride. TDS with total alkalinity, salinity, Sulphate, Chloride and Calcium. Calcium with EC, TDS, salinity and Sulphate. Total alkalinity with pH, EC, TDS, salinity, Chloride and Sulphate. Chloride with TDS, total alkalinity, EC and Sulphate. Calcium hardness with Sodium. EC and salinity shows perfect linear correlationas correlation coefficient = 1.

Conclusion

It can be concluded that ground water of the study area is highly saline. EC, Salinity, TDS and most of the ions are linearly correlated which further justifies the saline nature of the groundwater samples.

References

1. Mustafa Haqi Ismael, Balsam Salim Al-Tawash, Younus I. Al-Saady, Hydrochemical characteristics and environmental evaluation of surface and groundwater quality at Al-Tarmiyah Area, Baghdad, Iraq, *Iraqi Journal of Science*, 2019 Vol. 60, No.5, 1069-1084.
2. Mehdi Qasemi, MojtabaAfsharnia, Ahmad Zarei, MansourehFarhang&MohadesehAllahdadi, Non-carcinogenic risk assessment to human health due to intake of fluoride in the groundwater in rural areas of Gonabad and Bajestan, Iran: A case study, *Human and Ecological Risk Assessment: An International Journal*, 2018 DOI: 10.1080/10807039.2018.1461553.
3. Hui Jia, Hui Qian, Wengang Qu, Le Zheng, Wenwen Feng and Wenhao Ren, Fluoride Occurrence and Human Health Risk in Drinking Water Wells from Southern Edge of Chinese Loess Plateau, *Int. J. Environ. Res. Public Health*, 2019, 16, 1683.
4. Nakagawa, Kei; Amano, Hiroki; Asakura, Hiroshi; Berndtsson, Ronny, Spatial trends of nitrate pollution and groundwater chemistry in Shimabara, Nagasaki, Japan, *Environmental Earth Sciences*, 2016, 75(3), art. no.234, http://hdl.handle.net/10069/37000
5. A. K. M. Al-Amin, Md. ShahriarAzam, Md. Shazzadur Rahman, AfifaTajremin, M. K. Haque and TahminaAkterRimi, Impacts of Coal Stockpile on Soil and Water, *Archives of Current Research International*, 2019, 17(2), 1-15.
6. Rajesh Kumar Yadav and Monika, Influence of carcinogenic industrial pollutants on groundwater quality of RIICO industrial area of Bhiwadi (Alwar), Rajasthan, India, *Eco.Env. & Cons.* 27 (May Suppl. Issue): 2021; pp. (S407-S414).
7. Pratap Kumar Panda, Rahas Bihari Panda, and Prasant Kumar Dash, The Study of Water Quality and Pearson's Correlation Coefficients among Different Physico-chemical Parameters of River Salandi, Bhadrak, Odisha, India, *American Journal of Water Resources*, vol. 6, no. 4 (2018): 146-155. doi: 10.12691/ajwr-6-4-1.
8. Vinod Kothari, Suman Vij, SuneshKumar Sharma, Neha Gupta, Correlation of various water quality parameters and water quality index of districts of Uttarakhand,, *Environmental and Sustainability Indicators*, Volume 9, 2021, 100093.
9. Y. Dominic, Ravichandran and K. Ramakrishnan, Correlation and Regression Studies of Water QualityParameters: A Case Study of Water from the Bhavani River, *Asian Journal of Chemistry*, Vol. 19, No. 4 (2007), 2679-2682
10. Yadav RN, Dagar NK , Yadav R and Gupta P, Assessment of Ground Water Quality of Adjoining Area of the Bhiwari Industrial Area (Alwar), Rajasthan, *RJPBCS*, October – December 2011, Volume 2 Issue 4 Page No. 259.