A Case Study on a Few Aqua Industrial Region Villages of Santhabommali - Statistical Analysis of Groundwater Quality

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Abstract: **-**Since surface water supplies are becoming scarcer and more contaminated and because agricultural practices are becoming more and more in demand, groundwater is crucial for a variety of residential, commercial, and industrial uses. (Das, K.M., 2021). The concentration and quality of groundwater have a major impact on both agricultural output and human health (2020's Canter). An increasing body of research indicates that one major contributing reason to groundwater contamination is farmer usage of fertiliser and pesticides. This study, which was conducted in five separate villages in the santhabommali mandal of Srikakulam—Seethanagaram, Meghavaram, Marripaadu, Ummilada, Kollipaadu—used twenty groundwater samples collected during the pre-monsoon. Samples from a range of bore wells and wells were collected employing an irregular testing strategy in order to evaluate the chemical characteristics of the water quality parameters. The study looked at the optimum quantity of groundwater in the five aqua industrial villages of Seethanagaram, Meghavaram, Marripaadu, Ummilada, and Kollipaadu in the Santabombali mandal, as well as suitable treatment methods to try to make the water fit for human use.

Keywords*: pH, Sulphates, Chloride, Nitrates, TDS, and TH in groundwater samples.*

1. Introduction

Any kind of precipitation that descends the earth's crust after leaving the atmosphere, be it rain, snow, fog, or another, is either extremely pure or devoid of pollutants. Because there are so many chemicals present in naturalistic ecosystems, these kinds of precipitations are uncommon. Pure waters lost their capacity to sustain life due to environmental chemical deterioration. Water takes in atmospheric gases, but not before gathering them from the surrounding environment. The characteristics of water are determined by their type and quantity. Many boards or agencies of the Bureau of Ind. St. (BIS) have developed standards and guidelines for water quality due to the harmful consequences that different water quality components have on people's health and animals as well as irrigation ecosystems. Industrial effluents, agricultural runoff, and waste streams all have a significant influence on groundwater quality. The primary issues influencing groundwater resources include inadequate strong squander decommissioning, intemperate or unregulated aquifer drawing, off base strong squander transfer, and intemperate utilize of pesticides and composts in rural exercises.

Study Area

A Mandal called Santhabommali is situated in Andhra Pradesh's Srikakulam District. The Mandal contains 120 villages and 34 panchayats, and it is 8 metres above sea level. Srikakulam City is the neighbouring city. Santhabommali's study mandals are displayed in Figure 1.

Fig.1: Examine Mandal Area Map of the Villages

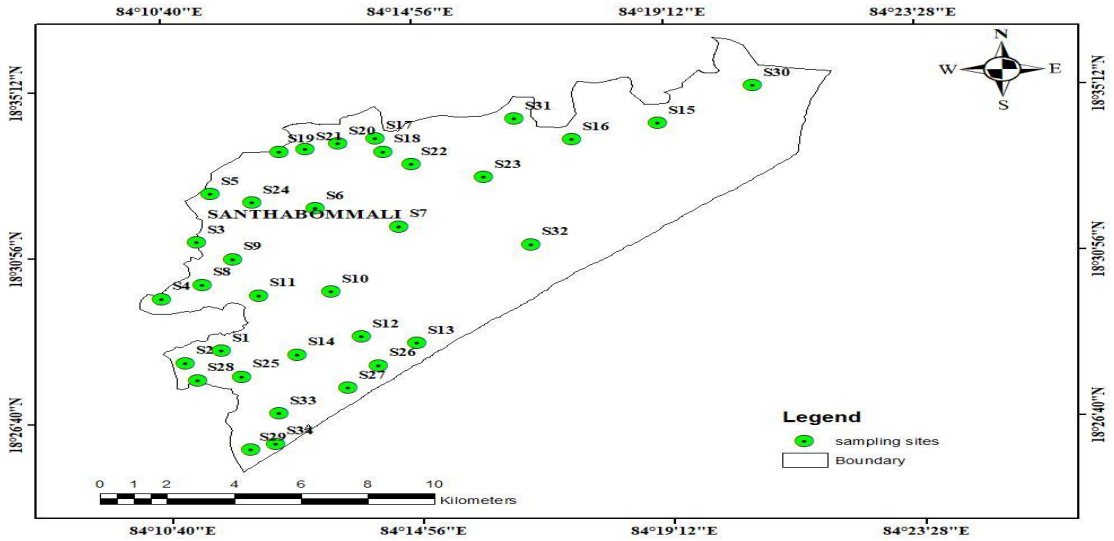


Fig.2: A few aqua industrial sampling stations in the study region

2. Objectives

The major research area is Santabombali mandal, which includes determining the best treatment methods to make water usable, comparing permissible limits to Indian standards, and analysing the characteristics of groundwater samples from five different communities.

3. Methods

Using hand pumps, groundwater samples have been gathered from the villages of *Seethanagaram, Meghavaram, Marripaadu, Ummilada, Kollipaadu* in anticipation of chemical analysis in the Chemistry Laboratory. The chemical properties of magnesium, pH, electrical conductivity, nitrates, and chlorides were analysed using standard laboratory protocols. Evaluating groundwater movement in the research region prior to the monsoon season is the aim of the project. The protocols outlined in the UNESCO report were followed for collecting water samples. Each sample that was taken at the study region was accurately documented in the specimens that were gathered. Samples are sent in bottles to the laboratory with safety precautions implemented (APHA 1998). Table 2 lists the methods for analysing water.

4. Results

Table 1 shows the pertinent results for the chemical parameters involved in the water quality of the groundwater samples that were taken before the monsoon. The different villages in the research region are represented by graphs of pH, EC, TDS, TH, chlorides, sulphates, and nitrates in Figures 2 through 8.

Table 1. Results of pre-monsoon groundwater samples collected in the study area

S. No.	Sampling Stations	pH	EC (mmhos/ cm)	TDS (mg/l)	Cl (mg/l)	TH (mg/l)	Sulphate (mg/l)	Nitrate (mg/l)
1	Seethanagaram: S1	6.98	2580	802	189	772	82	15
2	Seethanagaram: S2	6.91	2571	752	182	764	80	12
3	Seethanagaram: S3	6.88	2581	759	192	774	78	16
4	Seethanagaram: S4	6.93	2576	758	186	769	85	14
5	Meghavaram: S1	7.65	2508	1254	348	522	71	74
6	Meghavaram: S2	7.62	2501	1244	350	518	68	68
7	Meghavaram: S3	7.72	2512	1252	359	520	67	66
8	Megahavaram: S4	7.69	2507	1249	354	513	70.5	72
9	Marripaadu:S1	7.56	1532	1388	72	110	34	24
10	Marripaadu:S2	7.54	1534	1336	64.5	114	26	18
11	Marripaadu:S3	7.52	1536	1344	66	116	32	22
12	Marripaadu:S4	7.58	1538	1341	68.5	111	28.2	16.5
13	Ummilada:S1	7.70	3606	866	802	670	80	309
14	Ummilada:S2	7.58	3608	868	794	662	76	298
15	Ummilada:S3	7.42	3616	872	792	658	74	301
16	Ummilada:S4	7.64	3612	875	798	665	78	303.5
17	Kollipaadu:S1	6.99	1758	120	290	398	36	29
18	Kollipaadu:S2	7.52	1745	112	284	392	32	26
19	Kollipaadu:S3	7.56	1754	118	282	388	30	25
20	Kollipaadu:S4	7.59	1749	116	288	395	34	27

Table 2. Methods for Groundwater analysis

Test Conducted	Units	Principle of the method
P^H	levels	pH meter
Electrical conductivity	Millimhos	Digital conductivity meter
TDS	mgl^{-1}	Titration Method
TH	mgl^{-1}	Titration Method
Ca and Mg	mgl^{-1}	Titration Method
Chlorides	mgl-1	Titration Method
Nitrates	mgl^{-1}	Spectrophotometry

Source: Public Health Association (APHA) of America, 1998

Fig 3. pH represented graphically

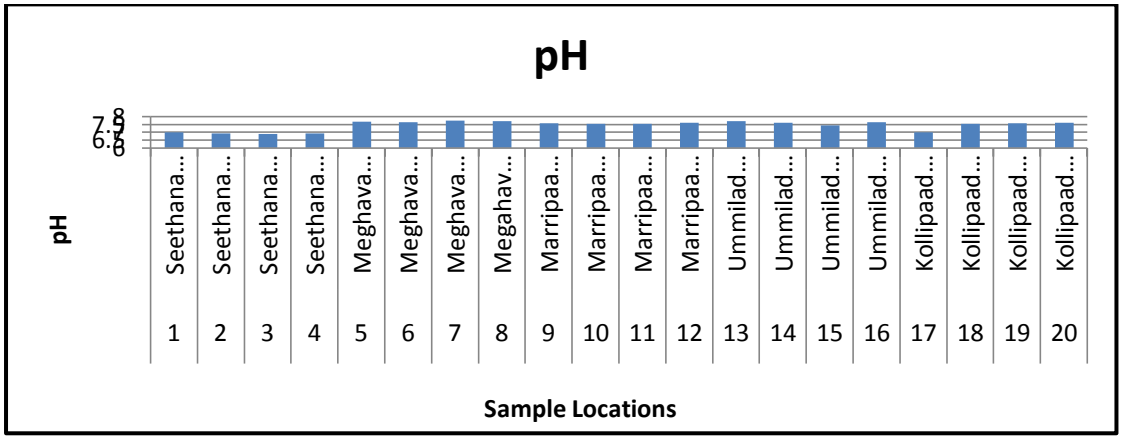


Fig 4. Graphical representation of EC

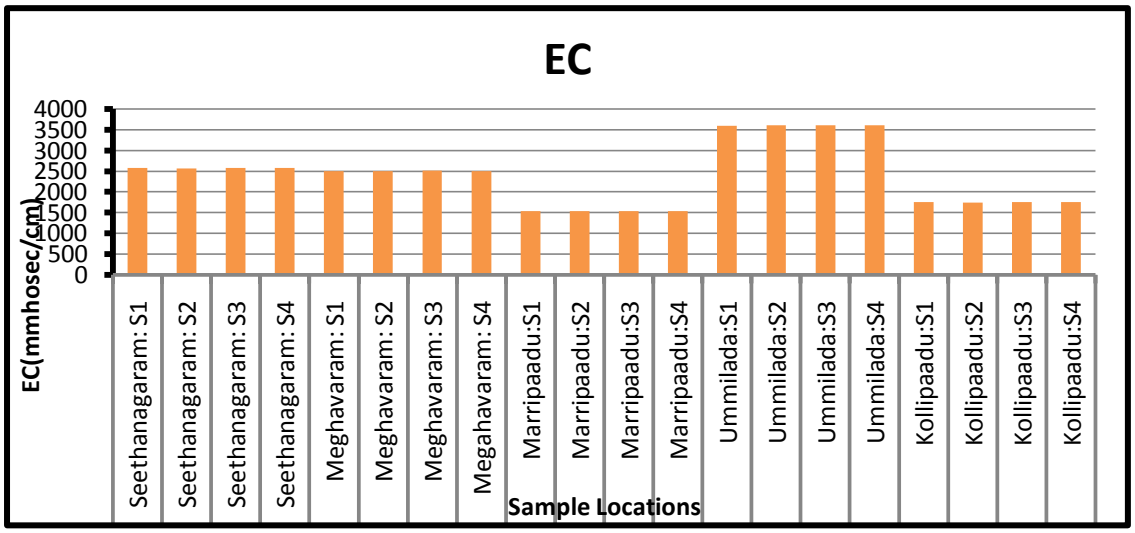


Fig 5. Graphical representations of TDS

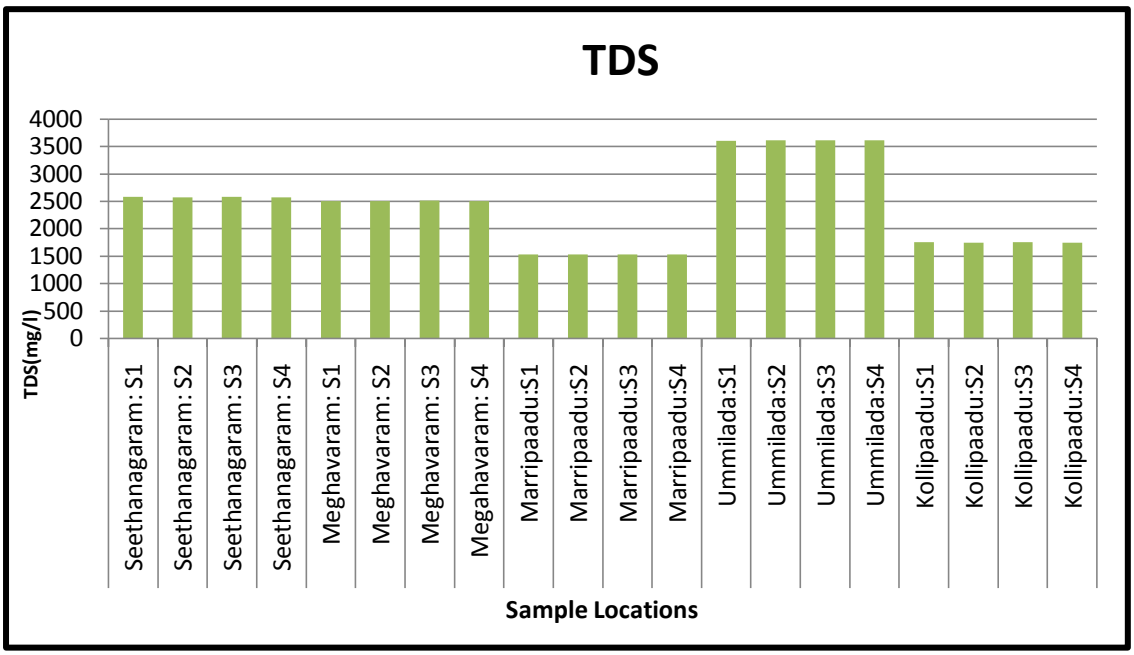


Fig 6. Graphical depiction of Cl

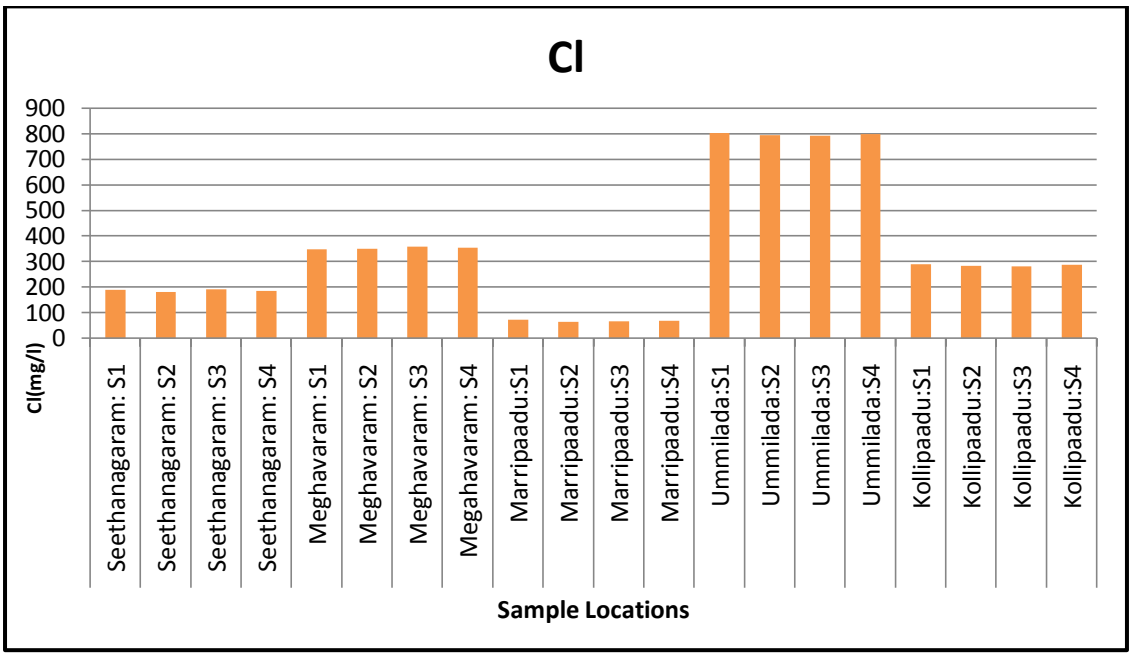


Fig 7. Graphical representations of TH

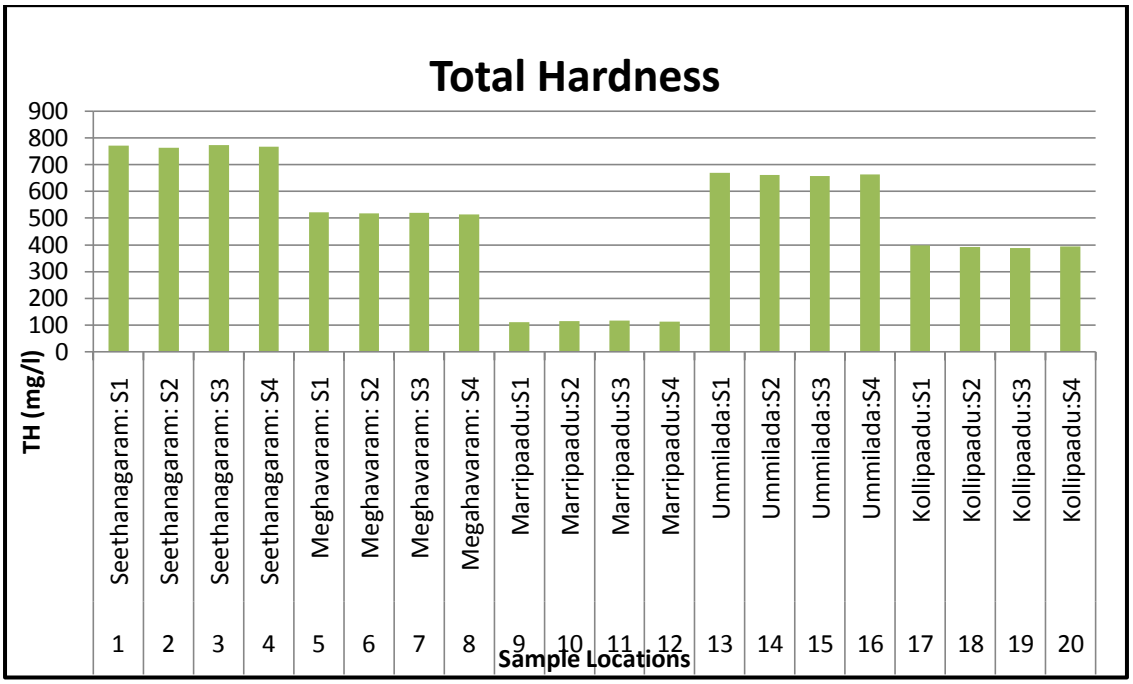


Fig8. Graphically represented of Sulphates

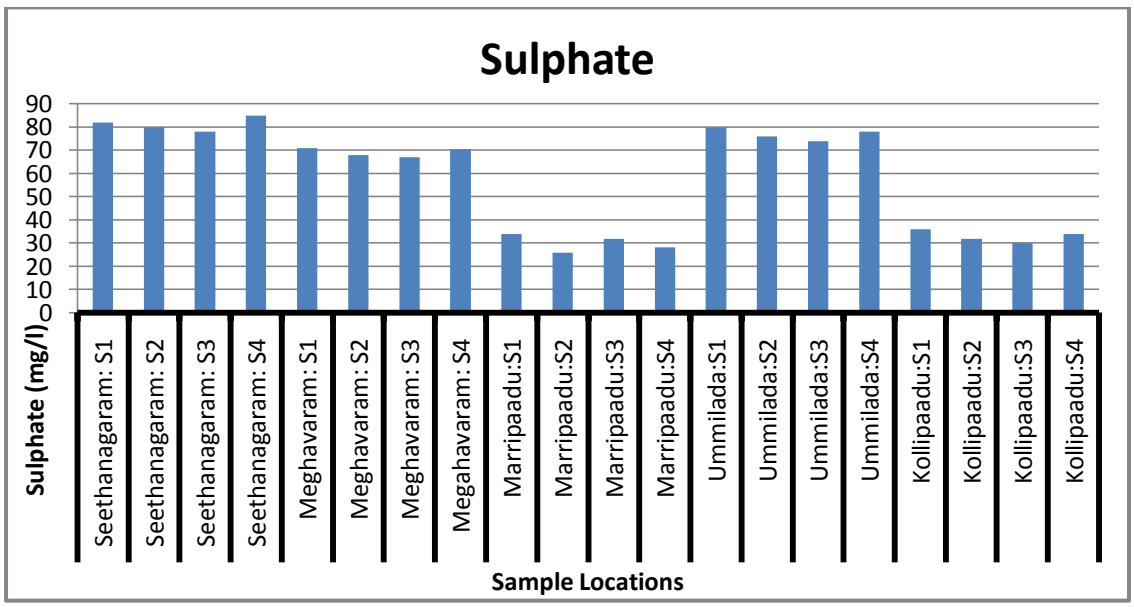
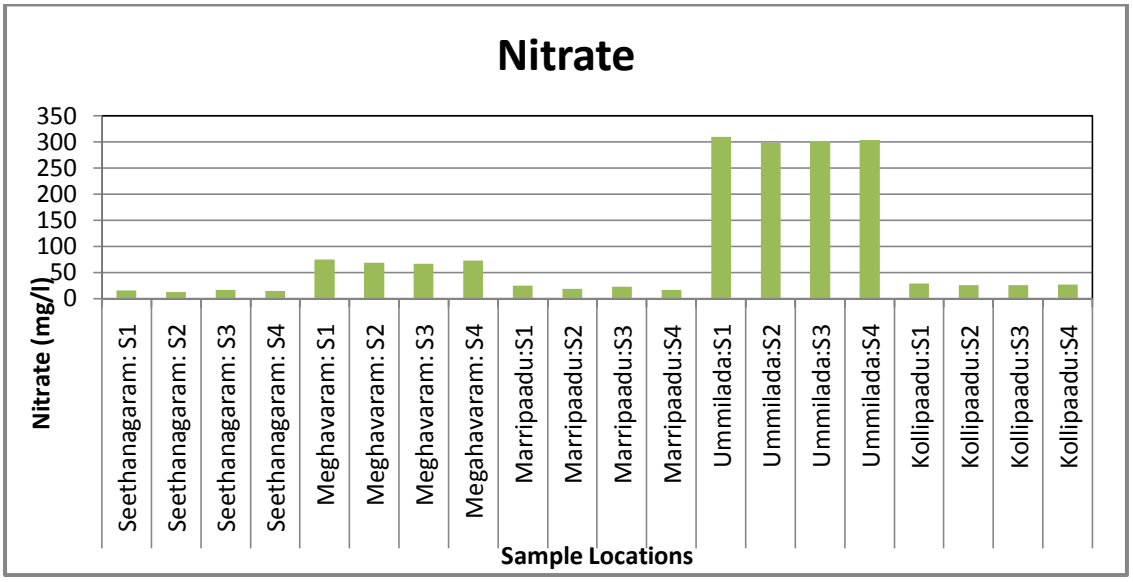


Fig 9. Graphical representations of Nitrates



5. Discussion

When compared to the WHO-permitted limitations, the groundwater in the research Mandal regions of *Seethanagaram, Meghavaram, Marripaadu, Ummilada, Kollipaadu* is biased in favour of smaller living forms. It was discovered that a large number of samples were a little and sparingly saline in nature, that total hardness concentrations were within permissible limits but slightly unsafe, that nitrate concentrations were within permissible limits but moderately safe, and that chloride concentrations were within acceptable constraints but moderately safeguarded. Raising public awareness requires ensuring the use of pollution control technology, prudent water usage, and proper sanitation.

Refrences

[1] ABBAS, M., SHEN, S.L., LYU, H.M., ZHOU, A. and RASHID, S. (2021) Evaluation of the hydrochemistry of groundwater at Jhelum Basin, Punjab, Pakistan. Environmental Earth Science, v.80, pp.1–17.

[2] ADIMALLA, N. (2020) Controlling factors and mechanism of groundwater quality variation in semiarid region of South India: an approach of water quality index (WQI) and health risk assessment (HRA). Environmental Geochemistry and Health, v.42, pp.1725-1752.

[3] BORA, M. and GOSWAMI, D.C. (2016) Water quality assessment in terms of water quality index (WQI): case study of the Kolong River, Assam, India. Applied Water Science, v.7, pp.3125–3135.

[4] CENTRAL POLLUTION CONTROL BOARD (CPCB) (2007) Status of Groundwater quality in India, Part-I. (www.cpcb.nic.in).

[5] Dutta, B., & Sarma, B. 2018,'Correlation study and regression analysis of ground water quality assessment of Nagaon Town of Assam, India', International Journal of Engineering Research and Technology, vol. 7, no. 6, pp.320-331.

[6] Dipu Sukumaran, Lotus Rani, AK, Harikumar, PS 2018, 'Water Quality Index (WQI) of Selected Dug Wells in a Coastal Area in Kerala, India', American Journal of Water Resources, vol. 6, no. 4, pp. 181-185.

[7] Edmunds, J.M. Cook, W.G. Darling, D.G. Kinniburgh, D.L. Miles, J.M. Margan and J.N. Andrew. 1987. Baseline geochemical conditions in the chalk aquifers, Berkshire, U.K. A basic for ground water quality management. Applied Geochem., 2 : 251-274.

[8] Fallahzadeh RA, Ghaneian MT, Miri M, Dashti MM. Spatial analysis and health risk assessment of heavy metals concentration in drinking water resources, Environmental Science and Pollution Research. 2017;24(32):24790–24802.

[9] G puat , .R , Singh, A.N. a dn Singh la , .A 102 9. cilppA a noit of NNA f ro water quality dni ex. nIt. .J Mach. Lear .n upmoC t.,)5(9 : 886 -69 .3.

[10] Hammed A Olayiwola et al. Physicochemical Assessment of Groundwater Quality from Hand Dug Wells and Boreholes of Part of Mokola-Eleyele, Ibadan Metropolis, Southwest Nigeria. International Journal of Advanced Engineering, Management and Science (ISSN: 2454-1311). 2020;6(2):080-090.

[11] Ibraheem M, Khan MN, Kumar RA. Seasonal variation of groundwater quality in Veppanthattai block of Perambalur district, Tamilnadu-implements of the water quality index method. Journal of Chemical and Pharmaceutical Research. 2015; 7(5):938-943.

[12] J n, C. K ,. aBdn oy p da h yay , A. a dn Bhadra, A. 002 9. sA se ss me tn of g dnuor water uq a til y f roniknird g esoprup ,rtsidict Na inital, ttUarakhand, .aidnInE vi or n . .tinoMsA sess., 1(661 - :)4 366 - 76 6.

[13] J. K. Tripaty and K. C. Sahu, “Seasonal hydrochemistry of groundwater in the barrier spit system of the chilika lagoon, India,” *Journal of Environmental Hydrology*, vol. 13, pp. 1–9, 2005.

[14] Kalra N, Kumar R, Yadav SS, Singh RT. Physico-chemical analysis of ground water taken from five blocks (Udwantnagar, Tarari, Charpokhar, Piro, Sahar) of southern Bhojpur (Bihar). Journal of Chemical and Pharmaceutical Research. 2012; 4(3):1827-1832.

[15] Lodh, R., Paul, R., Karmakar, B. and Das, M.K. (2014). Physicochemical studies of water quality with special reference to ancient lakes of Udaipur City, Tripura, India. Intern. J. Sci. &Resear. Publica. 4(6): 1-9.

[16] S. Dirican, “Assessment of water quality using physico-chemical parameters of camligoze dam lake in Sivas, Turkey,” *Ecologia*, vol. 5, pp. 1–7, 2015.

[17] O. Phiri, P. Mumba, B. H. Z. Moyo, and W. Kadewa, “Assessment of the impact of industrial effluents on water quality of receiving rivers in urban areas of Malawi,” *International Journal of Environmental Science & Technology*, vol. 2, no. 3, pp. 237–244, 2005.

[18] S. Kükrer and E. Mutlu, “Assessment of surface water quality using water quality index and multivariate statistical analyses in Saraydüzü dam lake, Turkey,” *Environmental Monitoring and Assessment*, vol. 191, no. 2, p. 71, 2019.