International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

A STUDY ON PHYSICO-CHEMICAL CHARACTERISICS OF GROUND WATER OF GULBARGA CITY

Dr M.N Dandgi[1], Shabnam Surria[2]

[1]Professor, Dept. of Civil Engineering, PDA College of Engineering Kalaburgi, Karnataka, India
[2]PG student, Dept. of Civil Engineering, PDA College of Engineering, Kalaburgi, Karnataka, India

---

Abstract Due to human and industrial activities the ground water is contaminated. This is the serious problem now a day. Thus the analysis of the water quality is very important to preserve and prefect the natural eco system. The assessment of the groundwater quality was carried out in the different wards of gulbarga City. The present work is aimed at assessing the water quality index (WQI) for the ground water of gulbarga City and its industrial area .The ground water samples of all the selected stations from the wards were collected for a physiochemical analysis. For calculating present water quality status by statistical evaluation and water quality index, following 15 parameters have been considered Viz. pH total hardness, calcium, magnesium, sulphate, phosphate, dissolved oxygen, nitrate, chloride, total dissolved solids, alkalinity, sodium, potassium, iron and BOD. The obtained results are compared with Indian Standard Drinking Water specification IS: 10500-2012. The study of physico-chemical and biological characteristics of this ground water sample suggests that the evaluation of water quality parameters as well as water quality management practices should be carried out periodically to protect the water resources.

Key Words: Ground water, water quality characteristics, correlation and regression analysis.

1. INTRODUCTION

Water is the most essential and valuable nature's gift to the mankind as well as the producer and consumer of this planet. Without water there would have been no life, hence it is a matrix of life. It is vital for many aspects of economic and social development for agriculture, energy production, domestic, industrial supply and it is a critical component of environment.

Presently, there is growing awareness that the development of water resources must be sustainable, which implies that the natural resources must be managed and conserved in such a way that it meets the needs for present and future generation. Groundwater is an important national asset and one of the earth's renewable resources which occurs as a part of hydrological cycle. It is primarily stored in aquifers, which are geological formations of permeable structured zones of rock sand or gravels. The quality of groundwater depends on the quality of soil through which it percolates. Most of the bacteria, organic compounds and biocides are filtered out during percolation. Ground water is used for domestic, industrial, water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Human health is threatened by unsanitary conditions through open drain carrying and disposing wastewater into natural water bodies. Rapid urbanization, especially in developing countries like India, has affected the availability and quality of groundwater due to its overexploitation and improper waste disposal, especially in urban areas.

1.1 SOURCE OF GROUND WATER:

Occurrence of ground water is as shown in Figure-1

After rain, some quantity of water may get in filtered into the soil which may move downward through a soil layer. Some water is dispersed through the soil and held by the capillary forces in the smaller pores or by molecular attraction around the soil particles. The water, after satisfying the retention capacity of the soil further moves downward into the regions where the pores of the soil or rock are completely filled with water. The water in this zone is called the groundwater. Figure 1 shows a schematic diagram illustrating the occurrence of groundwater.

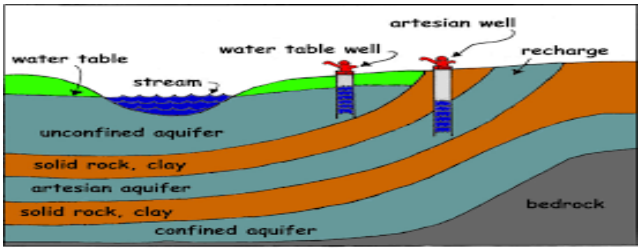

Fig.1: Occurrence of ground water

1.2 GROUNDWATER VARIATION IN KARNATAKA.

With a view to understand the broader quality criteria affecting the groundwater source in Karnataka, Rural Development and Panchayat Raj Engineering Department, RD & PRED Govt. of Karnataka, has collected 1,54,491 water samples, covering 33,667 villages/ habitations and analyzed the water samples, for 14 major parameters during the summer of year 2010. The quality concerns become important as the groundwater depletion is worsening rapidly. The water quality data from the sampled villages in the entire Karnataka State have reflected the contamination of groundwater with Bacteria(23%) and presence of excess Fluoride (17%), Total Dissolved Salts (4%), Total Hardness (25%), Iron (28%) and Nitrate (10%) beyond permissible limits.

2. METHODOLOGY

The study was conducted under ambient environmental conditions. Grab sampling method was used while sampling. Characteristics were tested as per methods prescribed by central pollution control board (CPCB) for the examination of ground water (21st edition 2012). The characteristics of the of ground water such as pH, total hardness, calcium, magnesium, sulphate, phosphate, dissolved oxygen, nitrate, chloride, TDS, alkalinity, sodium, potassium, iron, BOD had been analyzed. The Characteristics of ground water are conducted at ambient temperature the results obtained during the study are presented in Table-1.

Table 1: Characteristics of ground water

SL.NO.	characteristics	Observed values
1	PH	7.55
2	TH(mg/l)	839.16
3	Calcium(mg/l)	303.37
4	Magnesium(mg/l)	535.78
5	Sulphate(mg/l)	58.34
6	Phosphate(mg/l)	1.02
7	D.O(mg/l)	6.45
8	Nitrate(mg/l)	5.02
9	Chlorides(mg/l)	274.47
10	TDS(mg/l)	1247.33
11	Alkalinity(mg/l)	414.76
12	Sodium(mg/l)	3.02
13	Potassium(mg/l)	2.77
14	Iron(mg/l)	0.57

2.1 METHODS FOR ANALYSIS

2.1.1. Correlation and Regression

In the present study the correlation coefficient between the parameters is computed. The degree of line of association between any two water quality parameters is measured by correlation coefficient. The highest positive correlation between different parameters was found out to be 0.90 i.e., between Calcium and Total Hardness and the highest negative correlation between different parameters was found out to be -0.59 i.e., between Sodium and Calcium. If the correlation coefficient is ≥0.67 there

exists a relation between two parameters such as Ca& TH, Chloride & TH, Chlorides &Ca, TDS &Ca, TDS& Chlorides. For such parameters regression equations are computed.

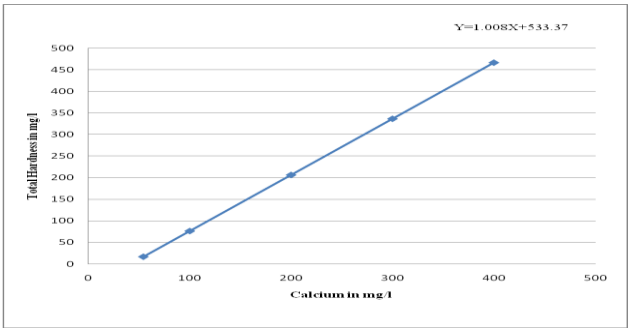

Figure 2.1.1 Regression Line calcium v/s Total Hardness

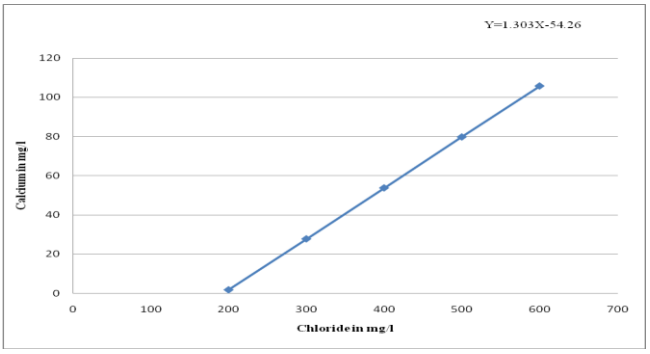

Figure 2.1.2 Regression Line for Chloride v/s Calcium

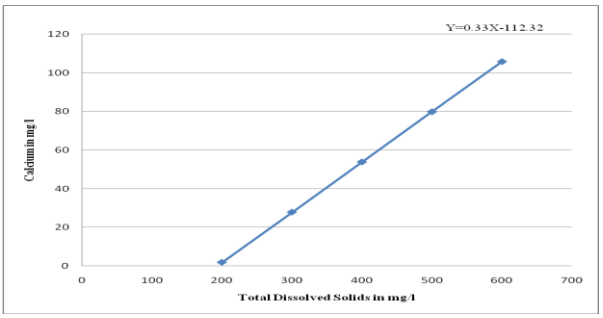

Figure 2.2.3 Regression Line for Total dissolved Solids

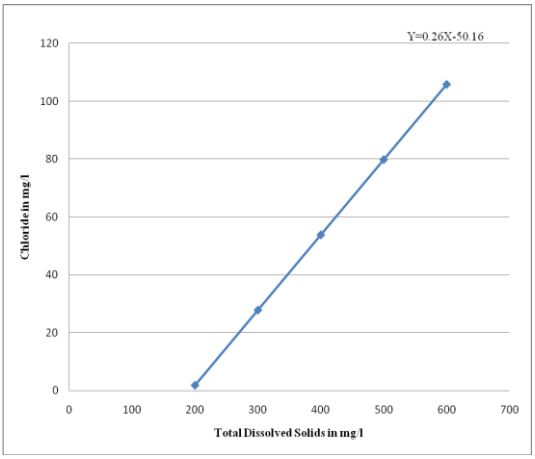

Figure 2.1.4 Regression Line for Total Dissolved Solidsv/sChloride

2.1.2. Water Quality Index (WQI)

A water quality index provides a single number (like a grade) that expresses overall water quality at a certain location and time based on several water quality parameters. The objective of an index is to turn complex water quality data into information that is understandable and useable by the public.

According to the concept of indices to represent gradation in water quality was first proposed by Horton(1965). The water quality index has been calculated by standards of drinking water quality recommended by the World Health Organization (WHO). Bureau of Indian Standards (BIS) and Indian council for medical research (ICMR). The weighted arithmetic index method has been used for calculation of WQI of groundwater of kalaburagi City. Further quality rating or sub index (Qn) is calculated by the following expression.

$Qn=100(Vn-Vin)/(Sn-Vin)$……(1)

Where

Qn= Quality rating for the n^{th} water quality parameter

Vn= Estimated value of the n^{th} parameter at a given sampling point

Sn= Standard permissible value of n^{th} parameter

Vin=Ideal value of n^{th} parameter in pure water.(i.e.,0 for all other parameters except the parameter pH and dissolved oxygen 7.0 and 14.6 mg/L respectively).

The overall water quality index was calculated by aggregating the quality rating with the unit weight.

$WQI=\Sigma QnWn/\Sigma Wn$……..(2)

Where $Wn=1/Sn$.

Table 2 shows the water quality index WQI and status of water quality.The comparison of estimated of water quality parameters with drinking water standards . The obtained values of water quality with regard to Physico-chemical parameters are shown in Table 2 .

Table2: Water Quality Index of Groundwate (Kalaburagi)

Parameters	Observed Values	Standard Values (Sn)	Unit Weight (Wn=1/Sn)	Quality Rating (Qn)	WnQn
pH	7.72	6.5-8.5	0.1176	50	5.88
TH	**839.16**	300	0.0033	279.72	0.9230
Ca^{+2}	**303.37**	75	0.0133	404.49	5.3797
Mg^{+2}	**535.78**	30	0.0333	1785.93	59.4714
SO_4^{-2}	58.37	150	0.0066	38.91	0.2568
D.O	6.45	5.0	0.2000	84.89	13.9780
NO_3^-	5.028	45	0.0222	11.17	0.2479
Cl^-	**274.47**	250	0.0040	109.78	0.4391
TDS	**1247.33**	500	0.0020	249.46	0.4989
Alkalinity	**414.76**	200	0.0050	207.38	1.0369

$\Sigma Wn=3.7922$

$\Sigma WnQn=725.12$

Water Quality Index

WQI=∑WnQn/∑Wn=191.21

2.2 EXPERIMENTAL RESULTS

This study clearly depicts that Total Hardness, Calcium, Magnesium, Chloride, Total Dissolved Solids and Alkalinity are exceeding the permissible standards. The water quality index of the samples is found out to be 191.21 which is poor quality of water. pH value of ground water is 7.55 indicates basic in nature. Nitrate of ground water is5.02mg/L respectively. Total dissolved solid of ground water is 1247.33mg/L. Chloride of ground water is274.47mg/L. phosphate of ground water is 1.02mg/L, Sulphate of ground water is58.34 mg/L. Iron content of ground water is 0.57mg/L.The calcium content of ground water is 303.37mg/l. The magnesium content of ground water is 535.78mg/l. The D.O content of ground water is 5.02mg/l. alkalinity, sodium, potassium and iron content of ground water is 414.76mg/l, 3.02mg/l, 2.77mg/l, and 0.57mg/l respectively.

3. CONCLUSIONS

1] The pH value of the samples indicates that the water is slightly alkaline in nature.

2] Most of the bore wells yields saline water with high dissolved solids.

3] The high values of water quality index (WQI) are due to higher values of Alkalinity, Total Dissolved Solids, Total Hardness, Calcium and Magnesium.

REFERENCES

1. B.Muralidhar Reddy “Evaluation of Groundwater Quality in and around Kolhar Industrial Area of Bidar City” M.E. Dissertation Submitted to GUG. Year 1995, pp. 22.
2. Ritesh, Jain, Jaspal Singh, Dr. S.K.Singh, “Groundwater Quality Analysis in Bathinda District” A Case Study, Journal of the Institution of Public Health Engineers India Volume 2001, November 1, PP. 38.
3. DebabrataMazamder and ParthaPratim Datta “Various Aspects of Denitrification in Surface and Groundwater Environment to Remove Nitrate” Journal of the Institution of Public Health Engineers, India, Vol. 2002, April – June No.2, PP. 23 – 29.
4. V.K. Garg, B.P. Sharma, Rakesh K.Hooda, “Groundwater Contamination in Urban Area” Journal of the Institution of Public Health Engineers India Vol. 2003, April – June No.2, PP. 22-28.
5. Linsley, R.K. FranziniJ.B.Freberg D.L. and Tchobanoglous “Water Resources Engineering”.