

AQUIFER CHARACTERISTICS IN AND AROUND KUNDAPURA-UDUPI DISTRICT KARNATAKA

AMEER HUSSAIN* H G UMESHCHANDRA** B.T SURESHBABU***

*UG SCHOLAR, DEPARTMENT OF CIVIL ENGINEERING, ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

** ASSOCIATE PROFESSOR, DEPARTMENT OF CIVIL ENGINEERING, ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

***PROFESSOR, ANGADI INSTITUTE OF TECHNOLOGY AND MANAGEMENT, BELAGAVI

Abstract: Groundwater is the major source of water supply for drinking and domestic purposes in urban as well as rural parts. Groundwater contamination is one of the most important environmental issues in the recent world. Coastal regions are generally vulnerable to seawater intrusion especially in regions where groundwater is over-pumped. Saline water interference is the main issue in coastal areas due to over-extraction of groundwater, and it directs to the devastation of the excellence of the freshwater aquifers.

The present study is being carried out to evaluate the groundwater quality and its suitability for domestic and drinking purposes in the coastal aquifers in Coastal regions of Kundapura-Udupi District. The parameters such as pH, EC, TDS and major ion concentrations Na, K, Ca, Mg, Cl, HCO₃, SO₄ and NO₃ of the groundwater are analyzed. Abundances of these ions are in the following order Na, Ca, Mg, K and Cl, HCO₃, SO₄, NO₃. Na and Cl is the dominant hydrochemical facies of the study area. Interpretation of the hydrochemical data suggests that hydrochemistry of the study area is controlled by mixing of fresh water with relict saline water, ion-exchange processes, silicate weathering and evaporation are responsible for the groundwater chemistry of the study area.

INTRODUCTION

Water is precious and most commonly used natural resource and is one of the important and cheapest natural resources available on this earth from various sources like Surface water, Ground water and Reservoirs etc. Earth surface is covered by 71% of water and remaining 21% forms the land area. Only 3% of the global content of approximately 1.4 billion cubic km of water is fresh and suitable for human use. Of this about 77.2% is permanently frozen, 22.4% occurs as groundwater and soil moisture, 0.35% of fresh water is contained in lakes and wet lands, less than 0.01% in rivers and streams. The atmospheric moisture is about 0.001%. Thus, fresh water is very limited resource. The Groundwater and Surface water in rivers and streams amount to a very tiny portion of the total water on the earth despite its importance to the mankind. The earth water is in the constant circulation through the hydrological cycle involving evaporation, precipitation and runoff.

Location and Accessibility: Kundapura is the taluq of Udupi district in Karnataka state of India. The village is 36 km. north of Udupi City (13° 37' 24" N Latitude and 74° 41' 30" E Longitude and 58 ft.msl). According to 2011 estimation Kundapura has a population of 3,98,471 and area of 1569 sq. km. is well connected by all weather and roads.

STUDY AREA

The study area is being one of the major cities on coastal Karnataka gaining economic importance due to urbanization and industrialization. The study area for our project consists of various schools and hospitals. Due to good accessibility and water resources available, agriculture is encouraged. There are different industries located in this region. As per the census report 2011 the population of study area is 3,98,471. This region is among heavy rainfall receiving areas of the world with an average annual rainfall of about 4344mm and actual of 4182mm. The average temperature during summer is 31-32°C and in winter 21-28°C. The Haladi is the main river in this area. It descends from the Western Ghats to the Arabian Sea. It slows down as it reaches the coast and spreads out into wide estuaries, lagoons, and backwaters with extensive mudflat and small patches of mangrove forest. The mouth of the estuaries and creek are narrow and prominently open to the sea. Many fish and prawn farms are located in the vicinity of the Kundapura. Much of the intervening coastline is sandy beach backed by coastal dunes, but there are some short stretches of rocky shore.

Objectives:

- To study the aquifers characteristics of the study area.
- To know the suitability of water for various purposes viz, drinking, industries and agriculture.
- To know the influence of meteorological parameters on water availability.
- Geological set up of the study area.
- Quantitative and qualitative analysis of water of Kundapura region.

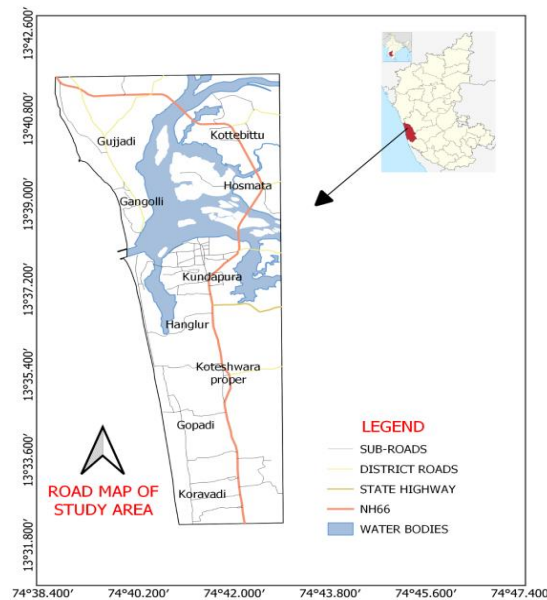


Fig.3.1 Road Map of Study Area
Materials and Methodology

Water sample are collected from various locations of aquifers, fixed by Grid Sampling method using QGIS from Kundapura area. White cans of one liter capacity are used for the collection of samples. Totally 13 water samples are collected from different bore wells and open wells. The sampling locations fixed are based on easy accessibility of water from various ground water sources which were near to the Sample Site Location plotted in Map using QGIS. The cans are rinsed thoroughly with distilled water and then with sample before pouring the sample into the can.

The collected samples were brought carefully to the environmental engineering laboratory with proper precautions. The collected samples are analyzed for physico-chemical parameters like pH, EC, Total Alkalinity, Total dissolved solids, Total Hardness, Calcium, Magnesium, Chloride, Sulphate. The details are as below,

SAMPLE LOCATIONS OF KUNDAPURA, UDUPI, KARNATAKA

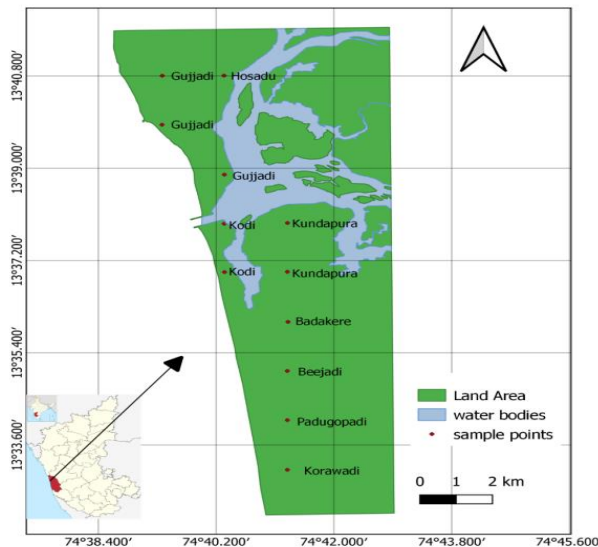


Fig.3.3 Sample Location Map by Grid Sampling method using QGIS

Results And Discussions

Quality of water, the most precious gift of nature, deteriorates due to human activities and making fresh water bodies unsuitable. The present study is carried out to find the physicochemical characteristics of Kundapura village area. We collected 13 water samples from various in and around the study area, testing various physical and chemical properties. We referred the BIS for the comparison of results obtained.

(mg/l) or ppm													
Sl. No.	Location	Source OW/BW	pH	EC (mS)	TDS	TH	Ca	Mg	Na	K	CO ₃	HCO ₃	Cl
1	KORAWADI	BW	4.14	0.281	0.183	120	80	40	19.82	4.72	0	224	34
2	PADUGOPADI	OW	6.57	0.284	0.185	136	108	28	22.98	5.42	0	216	28
3	BEEJADI	OW	6.6	0.473	0.307	108	76	32	32.12	9.63	0	32	32
4	BADAKERE	OW	6.68	0.221	0.144	80	44	36	12.83	11.84	0	144	11
5	KODI	OW	6.93	0.504	0.328	148	136	12	21.67	18.92	0	164	35
6	KODI	BW	7.14	1.296	0.842	204	200	4	14.89	9.53	0	152	26
7	KUNDAPURA	OW	6.43	0.146	0.095	76	68	8	8.23	3.22	0	88	9
8	KUNDAPURA	OW	7.12	0.327	0.213	80	60	20	8.92	16.15	0	204	17
9	UPPINAKUDRI	OW	7.95	0.884	0.575	92	80	12	97.54	0	0	176	265
10	GUJJADI	OW	5.85	0.043	0.028	44	28	16	5.68	1.26	0	56	12
11	HOSADU	OW	6.75	0.173	0.112	44	32	12	3.24	5.93	0	144	18
12	BENNGERE	OW	6.33	0.088	0.057	28	20	8	1.73	1.32	0	68	11
13	GUJJADI	OW	7.82	0.366	0.238	132	100	32	9.15	8.46	0	340	27

Table 1.1 Groundwater Chemistry of Kundapurataluk (mg/ltr values excluding pH and EC) in the month of Post-Monsoon.

(mg/l) or ppm													
Sl. No.	Location	Source OW/BW	pH	EC (mS)	TDS	TH	Ca	Mg	Na	K	CO ₃	HCO ₃	Cl
1	KORAWADI	BW	5.6	0.331	0.215	184	152	32	19.21	4.69	0	140	12
2	PADUGOPADI	OW	6.72	0.479	0.311	144	120	24	22.15	5.11	0	64	7
3	BEEJADI	OW	6.97	0.614	0.399	196	168	28	31.22	8.55	0	224	18
4	BADAKERE	OW	6.91	0.219	0.142	84	52	32	12.04	12.19	0	224	7
5	KODI	OW	7.8	0.544	0.364	136	128	8	21.31	19.21	0	232	13
6	KODI	BW	7.86	0.995	0.387	236	232	4	15.49	9.46	0	244	11
7	KUNDAPURA	OW	7.14	0.152	0.099	92	80	12	8.07	3.04	0	228	5
8	KUNDAPURA	OW	7.45	0.342	0.222	104	80	24	8.86	16.68	0	288	9
9	UPPINAKUDRI	OW	7.74	1.959	1.273	176	160	16	97.79	0	0	132	67
10	GUJJADI	OW	6.34	0.06	0.039	44	32	12	5.52	1.1	0	68	3
11	HOSADU	OW	7.28	0.22	0.143	84	68	16	3.83	5.72	0	156	6
12	BENNGERE	OW	6.97	0.081	0.053	52	24	28	1.82	1	0	196	5
13	GUJJADI	OW	8.14	0.378	0.246	132	92	40	8.97	8.38	0	388	16

Table 1.2 Groundwater Chemistry of Kundapurataluk (mg/ltr values excluding pH and EC) in the month of Pre-Monsoon.

Sl No	Characteristics	Desirable limit	Permissible limit as per BIS	Water sample not exceeding/deficit the permissible limit	Frequency
1	pH	6.5-8.5	No Relaxation	2,3,4,5,6,7,8,9,10,11,12,13	18
2	Electrical Conductivity	500µs/cm	2500µs/cm	1,2,3,4,5,7,8,10,11,12,13	18
3	Total Dissolved Solids	500mg/l	2000mg/l	1,2,3,4,5,7,8,10,11,12,13	14
4	Calcium	75mg/l	200mg/l	4,7,10,11,12	18
5	Magnesium	30mg/l	100mg/l	2,5,6,7,8,9,10,11,12	-
6	Sodium	-	250mg/l	1,2,3,4,5,6,7,8,9,10,11,12,13	18
7	Potassium	8mg/l	No Relaxation	1,2,7,9,10,11,12	18
8	Bicarbonate	-	-	1,2,3,4,5,6,7,8,9,10,11,12,13	18
9	Chloride	250mg/l	1000mg/l	1,2,3,4,5,6,7,8,10,11,12,13	18

Table 1.3 Characteristics of water for Post monsoon

to develop a strategy to manage the environmental hazards due to these elements and to improve environmental protection groundwater as these are water banks for future.

Sl No	Characteristics	Desirable limit	Permissible limit as per BIS	Water sample not exceeding/deficit the permissible limit	Frequency
1	pH	6.5-8.5	No Relaxation	2,3,4,5,6,7,8,9,10,11,12,13	18
2	Electrical Conductivity	500µs/cm	2500µs/cm	1,2,4,7,8,10,11,12,13	18
3	Total Dissolved Solids	500mg/l	2000mg/l	1,2,3,4,5,7,8,10,11,12,13	14
4	Calcium	75mg/l	200mg/l	4,10,11,12	18
5	Magnesium	30mg/l	100mg/l	2,3,5,6,7,8,9,10,11,12	-
6	Sodium	-	250mg/l	1,2,3,4,5,6,7,8,9,10,11,12,13	18
7	Potassium	8mg/l	No Relaxation	1,2,7,9,10,11,12	18
8	Bicarbonate	-	-	1,2,3,4,5,6,7,8,9,10,11,12,13	18
9	Chloride	250mg/l	1000mg/l	1,2,3,4,5,6,7,8,9,10,11,12,13	18

Table 1.4 Characteristics of water for Pre monsoon

pH: The pH scale is used to express degree of acidity or alkalinity. The pH of the water sample found to be between 4.14 - 8.14.

Electrical Conductivity:The electrical conductivity of water is a measure of the ability of a solution to conduct an electrical current. The EC of water is one of the important parameters used to determine the stability of water for irrigation. It is a determination of levels of inorganic constituent in water. EC ranged between 43 µS to 1959 µS.

Total Hardness :The total Hardness of water samples were found in the range of 28 mg/l to 236 mg/l. Water hardness is usually due to the multivalent metal ions, which comes from minerals dissolved in the water.

Calcium and Magnesium:Calcium and Magnesium are common constituents of natural water and contributors to the hardness in water. These salts breakdown on heating to form harmful scale in boilers, pipes and utensils. Calcium and Magnesium were found to be ranging from 20 mg/l to 232 mg/l and 4 mg/l to 40 mg/l respectively, where no water samples were excessive limits for calcium as well as magnesium.

Chloride:Chloride is the form of chloride ion and is one of the major inorganic anions. It gives a salty taste produced by chloride concentration which is variable and dependent on the chemical composition of water. The value of chloride obtained is ranging from 3 mg/l to 265 mg/l, where no water samples exceeded the excessive limits.

Sodium: Sodium is the form of sodium ions. Sodium is responsible for nerve function. The overdose of sodium may cause blood pressure, the sodium content analyzed in the laboratory by Flame Photometry. The concentration varied up to 1.73 mg/l to 97.79 mg/l.

Potassium: Elemental potassium does not occur in nature because it reacts violently with water. Potassium may be detected by taste because it triggers 3 of the 5 types of taste sensation, according to concentration. Potassium ions are an essential component of plant nutrition and are found in most soil types. It is used in agriculture, horticulture and hydroponic culture as fertilizer. The concentration of potassium in water samples varied up to 0 mg/l to 19.21 mg/l.

Conclusions and Suggestions

The area is characterized by heavy rainfall, high temperature and humidity. The area receives high rainfall, the annual average rainfall of the area is about 4000 mm per year. The maximum rainfall recorded is 4966.2 mm in the year 2020. The average annual temperature is about 36°C. Two warm and damp months of October and November when the south west monsoon will be retreating. Three cool months of December, January and February when generally dry conditions prevail. The hot months of March, April and May, this is the period of rising temperature. Four wet months of June, July, August and September.

It is observed that the water quality varied spatially and temporarily.

- The results obtained from Electrical conductivity is within permissible limit for all the sample in both the Pre monsoon and Post monsoon.
- In pH concentration, the places such as Padugopadi, Beejadi, Badaker, Kodi, Kundapura, Uppinakudri, Hosadu, Bennigere and Gujjadi is within permissible limit and pH concentration is slightly alkaline and slightly acidic in the month of Post Monsoon and Pre Monsoon.
- The value of TDS is within the desirable limit in all the months.
- The Total Hardness also lies within the desirable limit in all the months.
- In Korawadi, Badakere and Gujjadi area, the concentration of Magnesium exceeds the desirable limit in both Pre Monsoon and Post Monsoon.
- Sodium, potassium and chloride concentrations lies within the permissible limit.

Suggestions

The collected water samples indicated that the groundwater quality in the Kundapura area is good. Hence it can be used for Domestic, Agricultural and Industrial purpose. Further in future, the groundwater availability study can be made, Because of rapid growth of the city, there is much water demand. Hence the assessment of the water availability can be made. The effort is to be made for the sustainable development of the groundwater. The collected water samples indicated that the groundwater quality in the Kundapura area is good. Hence it can be used for Domestic, Agricultural and Industrial purpose. Further in future, the groundwater availability study can be made, Because of rapid growth of the village, there is much water demand. Hence the assessment of the water availability can be made. The effort is to be made for the sustainable development of the groundwater.

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