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Groundwater Quality Analysis in Davangere city of Karnataka, India

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Abstract: The analyses of ground water quality were studied in Davangere city. Five different sampling stations were select for analysis and compared the parameter of sampling station, for instance pH, alkalinity, hardness, turbidity, sulphate, chloride, fluorides, dissolved solids and conductivity. Variations in the physico-chemical parameters in the water sample were observed. The selected water sample parameters were compared with WHO norms which determine the groundwater quality of Davangere city were moderately contaminated and impact to health hazards.

Keywords: Groundwater, Water Parameters, Davangere, Karnataka, India.

I. INTRODUCTION

Groundwater is part of the Hydrological cycle. It is water that is located beneath the earth's surface in pores and crevices of rocks and soil. It moves much more slowly than surface water. Water can move down a river in hours, days or perhaps weeks. Groundwater in an aquifer may take ten, one hundred or many thousand years to flow through an aquifer. Management of groundwater needs to consider the amount of water going into the aquifer. Groundwater is an important resource all over the world. The term groundwater is usually reserved for the subsurface water that occurs beneath the water table in soils and geologic formation that are fully saturated. It supports drinking water supply; livestock needs irrigation, industrial and many commercial activities [7]. Groundwater is generally less susceptible to contamination and pollution when compared to surface water bodies 8. In India, where groundwater is used intensively for irrigation and industrial purposes, a variety of land and water based human activities are causing pollution of this precious resource [8].

In Davangere city fractured granitic- gneisses and gneisses are the main water bearing formations. Ground water occurs within the weathered and fractured rocks under water-table conditions and semi-confined conditions. Ground water exploration reveals that aquifers are encountered between the depths of 8.46 and 32 mbgl. In Davangere bore wells were drilled from a minimum depth of 35 to a maximum of 200 mbgl. Depth of weathered zone ranges from 5.5 mbgl to 30 mbgl. The main objective of this research work is to analyze some physico-chemical parameters of the ground water of Davangere city, Karnataka.

II. MATERIALS AND METHODS

Study Area

Davangere is a district head quarters located 260km from the state capital Bangalore Karnataka India, at 13°.5' and 14°50'N and 75°30' and 76°30'E geographically. Davangere district receives average annual rainfall of 644 mm (25.4 inch). The district enjoys semi arid climate, dryness in the major part of the year and hot summer. In general, southwest monsoon contributes 58 % of total rainfall and northeast monsoon contributes 22 % rainfall. The remaining 20 % rainfall is received as sporadic rains in summer months. It receives low to moderate rainfall. The groundwater quality is degrading in Davangere city is due to increases human habitation and commercial practice. Therefore, we have decided to analyze its groundwater so that some remedies for the improvement could be possible.

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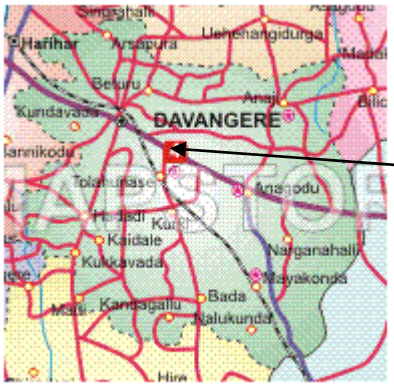
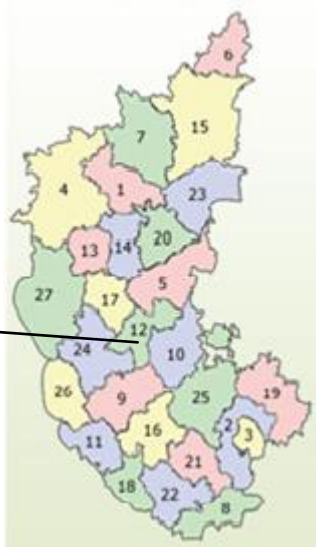
Map of the Study Area



Davanagere city map



Map of Karnataka

Groundwater samples were collected from five different sampling locations of Davangere city during the pre-monsoon (April and May 2011) monsoon (July and August2011) and post monsoon (January and February 2012). The collected water samples were transferred into pre cleaned plastic water bottles for analysis of chemical characters. Samples collected in black colored carbouys of 3 liters capacity bottle, study sites were properly labeled and a recorded. The various physiochemical parameters were analyzed and health impact of chemical parameters are reported (Table 3, 4, 5). Total alkalinities of the water samples were determined by titrating with N/50 H_2SO_4 using phenolphthalein and methyl orange as indicators. The chloride ions were generally determined by titrating the water samples against a standard solution of Ag No_3 using potassium chromate as an indicator. The conductivity of the water samples were measured using the conductometric method. The total hardness of the water samples were determined by complex metric titration with EDTA using Erichrome balck-T as an indicator. Sulphate and fluoride of the water samples were estimated by UV-visible spectrophotometer. TDS of water sample were measured using gravimetric method.

Table: 1 Showing sample station in study area.

Sampling Station No	Sampling Stations	Number of Samples Taken	Condition of area
1	Vidya Nagar	3	Residential area
2	C.J Hospital	2	Hospital and Commercial area
3	Hadadi road	1	Residential and commercial area
4	Chowkipette	2	Populated area
5	Mandipette	3	Populated and Business area

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Table: 2 Showing List of parameter and estimation method.

Sl. No	Parameters	Method of Estimation
1	pH	pH Meter
2	Alkalinity	Conductivity
3	Hardness	EDTA Titration
4	Turbidity	Turbidity meter
5	Sulphate	Turbidiometeric Method
6	Chloride	Silver nitrate Method
7	Fluoride	Ion-Selective Electrode
8	Dissolved Solids	Conductivity meter
9	Conductivity	Conductometer

III. RESULT AND DISCUSSION

The sample are collected from Davangere city were analyzed. The analysis (Table 2) of ground water samples includes the determination of concentration of inorganic constituents. The physico- chemical parameters, which were analyzed in pre monsoon, monsoon, post monsoon season, it have been shows in Table 3, 4, 5. The desirable pH range is necessary for drinking water from 7.0 to 8.5. The pH value of water sample in the study area is narrow ranged within permissible limits from 7.2 to 8.0. On an average, pH of 7.6 Total alkalinity of water is varied from 100-230mg/l in all season. The values of total alkalinity were comparatively moderate. The high content of alkalinity is shown in the station 2(C.J. Hospital) in pre monsoon season, where as low content in station 4 (Chowkipette) at rainy season. In the present study water were hard and crossed the permissible limits in pre and post monsoon season (600-800mg/L) it is mainly due to the leaching of igneous rock and carbonate rocks (dolomite, calcite and limestone). Generally hard water originates in the areas where thick top soil and limestone formations were present and its seepage, maximum permissible level prescribed by WHO for drinking water is 500 mg/l as set. Chloride concentrations in the water samples were low in monsoon season (80-100mg/L). According to WHO, maximum permissible limit for chloride is 500mg/l. The value observed in present study is in the range below permissible limit. The sulphate content varies between 8 to 50 mg/l and the fluoride content varies between 0.1 to 0.9 mg/l. The sulphate and fluoride values were also found to be within the prescribed limits. TDS is commonly found as carbonates, bicarbonates, chlorides, sulphates and nitrates of calcium, magnesium, sodium, potassium, Iron and manganese mineral containing rocks. The high concentration of dissolved solids increases the density of water and influences osmoregulation of fresh water organisms. The water samples Mandipette area (1040 mg/L) and Hadadi road (1120 mg/L) were found to possess high TDS value when compared with other sampling station. The TDS value is low for the water sample collected at Vidya nagar (500 to 800 mg/L). Total dissolved solids have showed the significant positive relation with the electrical conductivity, chloride, alkalinity, sulphate, total hardness, calcium and magnesium. Conductivity of ground water samples varies between 900 to 1300 μ mho/c.

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Table 3: Average results of ground water quality parameters in pre-monsoon season (April and May 2011)

Station Number	Parameters								
	pH	Alkalinity mg/L	Hardness mg/L	Turbidity NTU	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Dissolved Solids mg/L	Conductivity µ mho/cm
1	7.8	140	400	3	40	100	0.3	648	900
2	7.9	230	800	2	60	250	0.5	880	1100
3	8.0	130	600	1	50	310	0.9	1120	1400
4	7.7	220	400	1	80	250	0.4	960	1200
5	7.8	190	400	3	70	320	0.2	880	1100

Table 4: Average results of ground water quality parameters in monsoon season (July and August 2011)

Station Number	Parameters								
	pH	Alkalinity mg/L	Hardness mg/L	Turbidity NTU	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Dissolved Solids mg/L	Conductivity µ mho/cm
1	7.5	120	350	4	30	90	0.1	576	800
2	7.4	110	600	2	20	85	0.3	648	900
3	7.3	135	500	1	15	100	0.1	800	1000
4	7.2	100	300	3	10	110	0.5	880	1100
5	7.4	150	330	3	8	80	0.7	960	1200

Table 5: Average results of ground water quality parameters in post-monsoon season (January and February 2012)

Station Number	Parameters								
	pH	Alkalinity mg/L	Hardness mg/L	Turbidity NTU	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Dissolved Solids mg/L	Conductivity µ mho/cm
1	7.6	130	380	1	15	110	0.7	800	1000
2	7.7	170	700	1	25	220	0.3	960	1200
3	7.8	200	550	4	45	320	0.5	960	1200
4	7.6	180	350	2	50	200	1.0	1040	1300
5	7.7	160	390	3	30	350	0.9	960	1200

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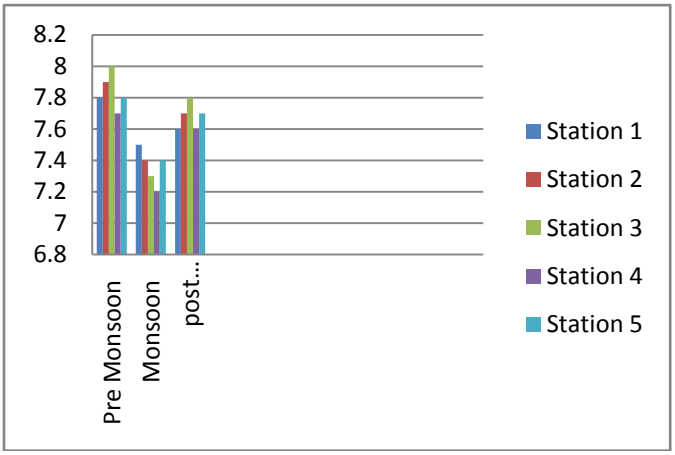

Fig 1 Seasonal Variation of pH in study area

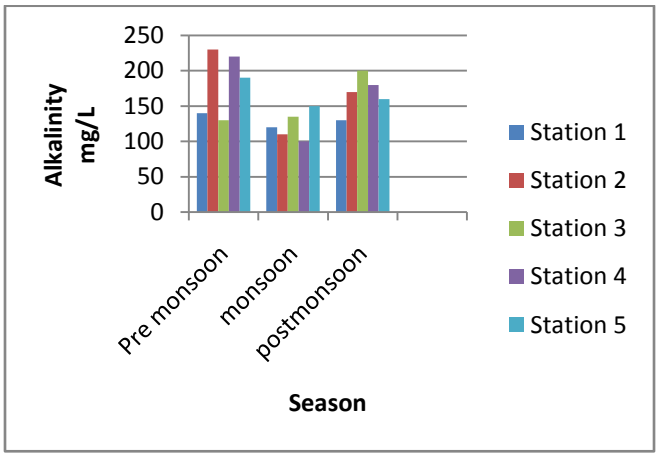

Fig 2 Seasonal Variation of Alkalinity in study area

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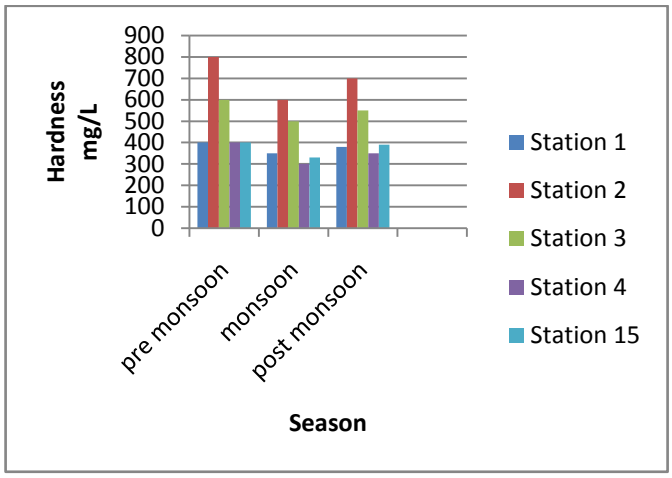

Fig 3 Seasonal Variation of Hardness in study area

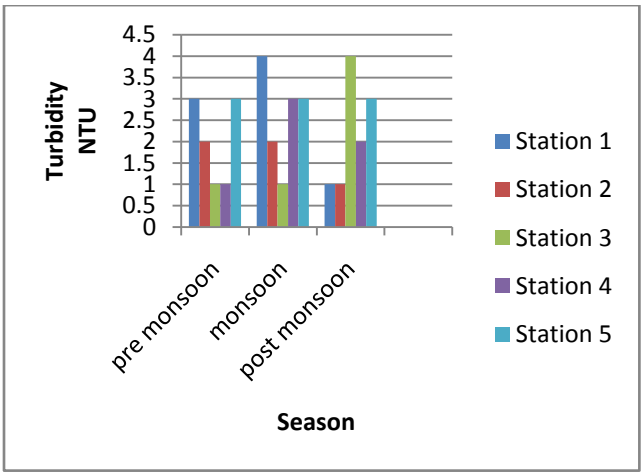

Fig 4 Seasonal Variation of Turbidity in study area

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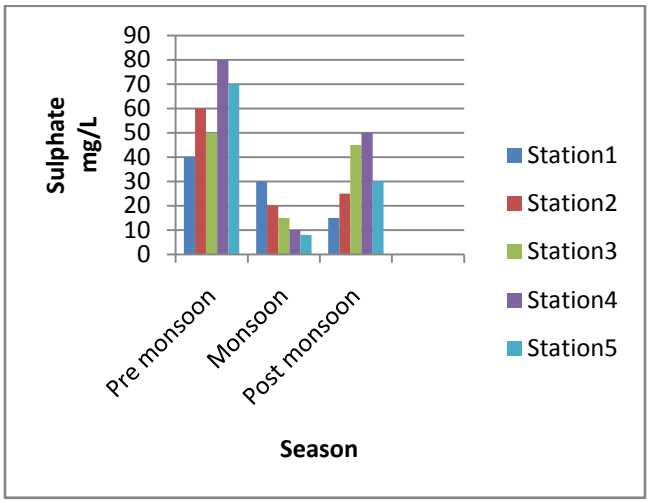

Fig 5 Seasonal Variation of Sulphate in study area

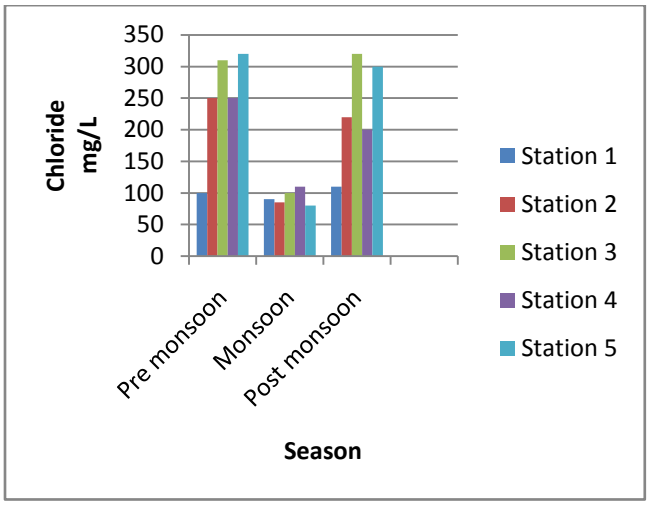

Fig 6 Seasonal Variation of Chloride in study area

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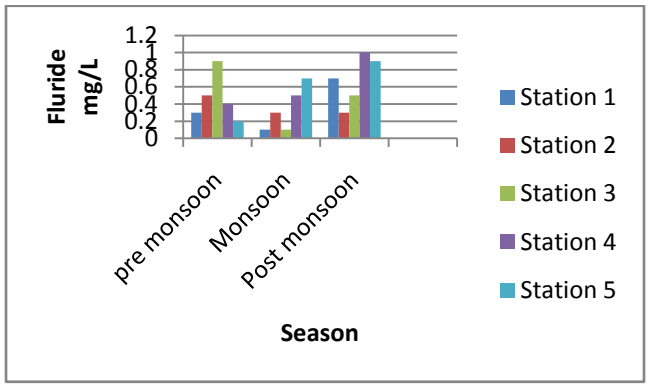

Fig7 Seasonal Variation of Fluoride in study area

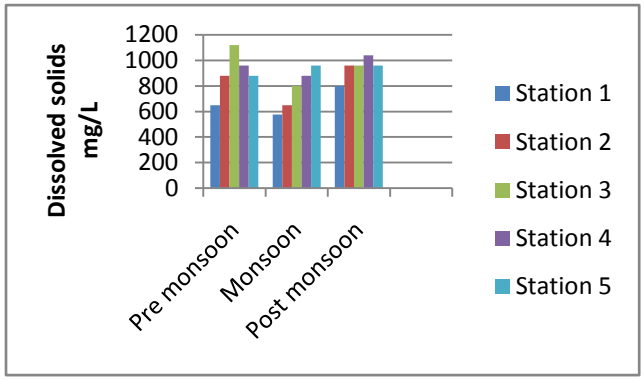

Fig 8 Seasonal Variation of Dissolved solids in study area

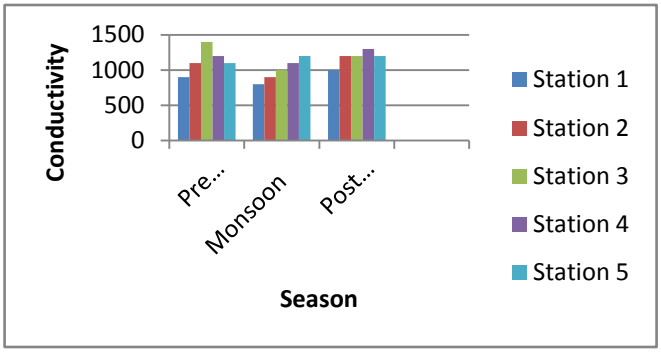

Fig 9 Seasonal Variation of Conductivity in study area

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IV. CONCLUSION

Currently carried research investigation should give more precise answer on influence of geo morphological condition than anthropogenic activities in the examined groundwater samples of the study area. Local geological settings may support the increasing concentration of physico-chemical characteristics in groundwater. The factors like slow circulation, longer period of contact between aquifer and water, dissolving of minerals at the time of weathering, residential time, drainage pattern and surface water link. Porosity of the soil and rock also alters the characteristics of the groundwater.
The high level contents of the parameters observed may be minimized if the groundwater is recharged with the available water in the rainy season. This not only dilutes the constituents of the groundwater but also raises the groundwater level that depletes due to large-scale exploitation.
Groundwater is extremely important to the future economy and growth of rural India. If the resource is to remain available as high quality water for future generation it is important to protect from possible contamination. Hence it is recommended that suitable water quality management is essential to avoid any further contamination.

The study area shows the moderately contaminated with total dissolved solids and hardness in samples. Ground water Parameters in sampling sites have varied due to anthropogenic activities, but this value does not have any harmful impact for the water to use for drinking purpose. Hence the ground water in Davangere city area is suitable for drinking, commercial, Industrial, and agriculture purposes.

V. ACKNOWLEDGEMENT

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