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A preliminary assessment of groundwater quality in Thrissur District, Kerala, India

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ABSTRACT

Ground water quality assessment described with 46 samples collected from Thrissur district in Kerala, India. Groundwater samples were anylsed for water quality parameters using standard methods. For the better understanding and simple representation of water types, Piper plot and Schoeller diagrams were employed. Dominant water types in the groundwater are Na-Cl, Ca-HCO3, and Ca-Na-HCO_3. Major quality parameters such as pH, EC, Ca, Mg, Na, K, Cl, SO_4, HCO_3, CO_3, NO_3 and F were analysed. Results were compared with WHO standards. This inferred that the groundwater in the Thrissur district is extremely suitable for the drinking purposes.

Introduction

Water is precious and a vital recourse for human life and development. Monitoring of water resources has become a key act for maintaining the quality that prevents pollution. Water quality is certainly affected by the quantity and quality of supplies coming from different sources. Therefore, overall national planning and resource management in respect to water with emphasis on allocation of priorities among the different uses is necessary (Alobaidy et al. 2010). Kerala is the southernmost state of India, is very unique in the groundwater situation, than many other states in India. This part of the country is blessed with over 3000mm of rainfall per year. Thrissur is the central district of the state with a special well culture. Mostly each and every home has a dug well. Groundwater level is shallow in many locations. Groundwater is the major source of drinking water in the district. There were not many water quality problems were reported for the Thrissur district, except few locations in the coastal regions. Under the heavy population growth and the increased sources of pollution it is important to evaluate the groundwater quality for the safe water supply for drinking and other domestic purposes. Present study assessed the groundwater quality under the variable socio-economic conations, in order to ensure the safe water supply.

Materials and methods

Thrissur district lies between North latitudes 10° 10´22´´ and 10° 46´ 54´´; and East longitudes 75° 57' 20'' and 76° 54' 23´´, in the Survey of India Toposheet No. 58 B and 49 N. The average annual rainfall ranges between 2180.0 and 3484.0 mm in the district and mean annual rainfall for the district is 2924.4 mm. The average annual maximum temperature is 32.30°C and the average annual minimum temperature is 23.3^{0}C. The major soil types are the laterite soil, brown hydromorphic soils, hydromorphic saline soils, coastal alluvium, riverine alluvium and forest loamy soil. The aquifer system in the district can be broadly divided into hard rock aquifers, the laterite aquifers and sedimentary aquifers. The hard rock and laterite aquifers constitute major aquifer system of the district while the sedimentary aquifers are seen along the coast and river courses. Groundwater occur under phreatic, semi confined to confined conditions in the weathered and fractured portions of the crystalline formations and occur semi-confined and confined condition in deep seated fractured and sedimentary formations.

A total of 46 groundwater samples were collected from different parts of the district. Water is pumped out for a fair amount of time prior to the collection. Water samples were collected in polyethylene bottles (1 *l* capacity). Bottled were sealed and brought to the laboratory for analysis and stored properly (4°C) before analysis. Analysis was carried out as per the standard methods suggested by APHA (1995). EC and pH were analysed in the field itself using the portable digital meters. Major ions like Ca, Mg, Na, K, CO_3, HCO_3, Cl, and SO_4 were analysed. Mostly the anions were analysed by titration, except for sulphate. UV visible spectrophotometer was employed for sulphate, fluoride and nitrate. Sodium and potassium were analysed using flame photometer. Calcium and magnesium were determined by titration with EDTA. Spectrophotometer was again used for nitrate and fluoride estimation.

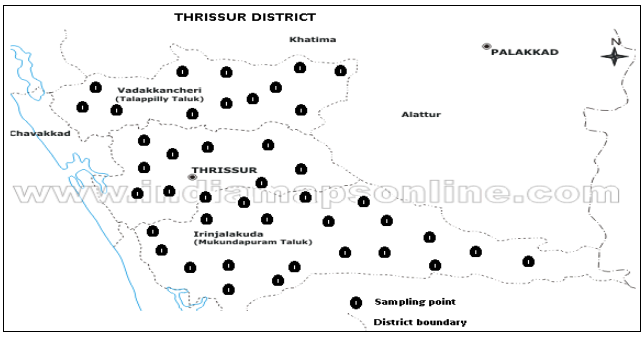

Fig.1 Location map of the study area with sampling points

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Results and discussion

Statistical summary of the groundwater quality parameters are presented in Table 1. The distribution of the same is plotted in a box-whisker plot (Fig. 1). Groundwater was mainly alkaline in nature, ranged between 7.5 and 9.8, with an average of 8.5. Permissible limit were exceeded in few samples, 8.5. Electrical conductivity exhibited a wide range (24-814µS/cm) of concentration. The average value 222.9 µS/cm suggest that, all samples were well within the maximum permissible limit of 1500µS/cm.

In the cation chemistry, Ca ranged from 0.8 - 42 mg/l with an average of 12.2 mg/l. As per the range, all the samples satisfied the drinking water standard 75 mg/l (WHO 1993). This indicates that the calcium concentration in most of the water samples is lower than the standard values. The major origin of Ca can be attributed to the geologic formations. In the present study high Ca may be derived from the rock water interactions. Magnesium concentration was ranged between 0 to 37.7 mg/l. As per the drinking water quality standard by WHO (1993), permissible limit of Mg is 50 mg/l. Higher concentration Mg is originated from the weathering of ferromagnesian minerals such as pyroxenes, amphiboles and micas. Results show that the Mg concentration satisfies the permissible limit for drinking. In this study, concentration of Na ranges from 2.3- 116 mg/l, with an average of 19.4 mg/l. Potassium in the study area varied between 0.3-19 mg/l with an average of 5 mg/l. Both Na and K are well within the permissible limit of 30 mg/l.

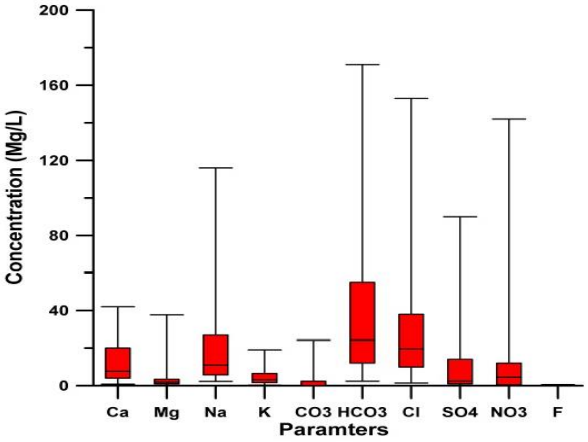

Fig. 2 Box plot water quality parameters

In drinking-water chloride originates from natural sources, sewage and industrial effluents, urban runoff containing de-icing salt and saline intrusion (WHO 2011). The most desirable limit of Cl in drinking water is 200mg/l. The concentration of Cl was in the range of 1.4 - 153 mg/l, with an average of 33.7 mg/l. Chloride concentrations in excess of about 250 mg/l can give rise to detectable taste in water. Sulphate in the study area varied between 0- 90 mg/l. All the samples fall well within the allowable limit of 400 mg/l. Carbonate was mostly absent in the water samples, it ranged between 0-24 mg/l. Bicarbonate showed a range of concentration from 2.4 -171 mg/l, with an average of 39.8mg/l. it is the major factor which controls the alkalinity in groundwater. Nitrate concentration in the groundwater may be from the natural as well as anthropogenic formations. In the present study it was in the range of0.5 - 142mg/l, with an average concentration 12.6 mg/l. One sample was above the permissible limit 45mg/l (WHO 2011). Occurrence of fluoride is largely controlled by geologic formations. High fluoride in drinking water may cause fluorosis. Fluoride in the study area ranged between 0-0.56 mg/l.

Groundwater types were assessed by a piper trilinier diagram (after Piper 1953). A well spread of samples were seen for the groundwater in Thrissur district (Fig. 3). Major types of water are Na-Cl, Na-Ca-HCO_3, and Ca-HCO3. However majority of them were fall in the Na-Cl and Ca-HCO_3 types. The major contributing ions towards the water type are Na, Ca, Cl and HCO3. This fact is further confirmed by the Schoeller diagram (After Schoeller 1965, Fig. 4). Dominance of the Na and Ca hints to the cation exchange processes through the rock-water interactions.

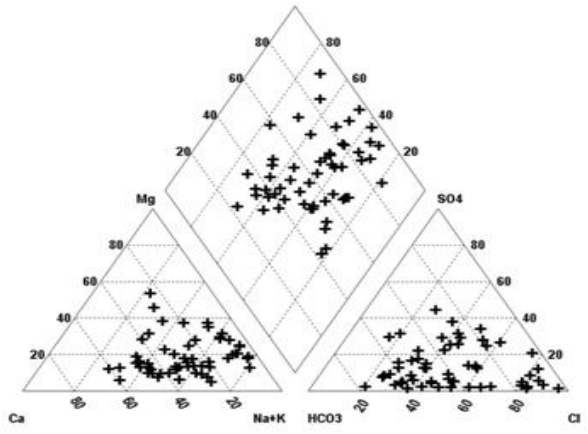

Fig. 4 Piper plot

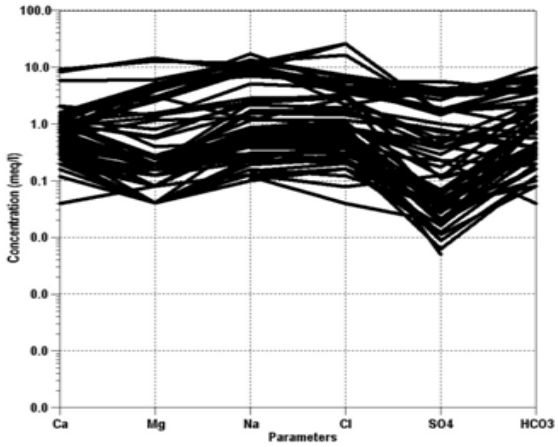

Fig. 5 Schoeller diagram

Conclusions

Groundwater quality of the Thrissur district was evaluated in this study. All the samples were alkaline in nature. Piper diagram showed that, major water types were identified as Na-Cl, Ca-Na-HCO_3 and Ca-HCO_3. Dominant ions in the study area were Na, Ca, HCO_3 and Cl. This is supported by the Schoeller diagram. Results of the water quality parameters were compared with WHO standards. This showed that groundwater quality in the study area is exceptionally good for drinking purposes. High amount of rain received through monsoon is acting is the key factor in maintain such an excellent water quality.

References

Alobaidy, Abdul Hameed M. Jawad, Haider Abid S, Bahram Maulood K (2010) Application of Water Quality Index for Assessment of Dokan Lake Ecosystem, Kurdistan Region, Iraq, Journal of Water Resource and Protection 2 : 792-798.

APHA (1995) Standard methods for estimation of water and waste water. 19th edition,Washington DC, American Public Health Association

Piper, A.M. A Graphic Procedure in the Geochemical Interpretation of Water Analysis. Trans. US Geol, Surv, Groundwater Notes. 1953. 12.

Schoeller, H. (1965). Hydrodynamique lans lekarst (ecoulemented emmagusinement). Actes Colloques Doubronik, I: AIHS et UNESCO, 3-20.

WHO (1993) Guidelines for drinking-water quality, Vol 2– Health criteria and other supporting information and Vol 3 – Drinking water quality control in small community supplies

WHO (2011) Guidelines for Drinking-water Quality, fourth edition, World Health Organization, Geneva, Switzerland, http://whqlibdoc.who.int/publications/2011/9789241548151_eng.pdf.