

Groundwater Evaluation of Veppanthattai in Perambalur District, Tamilnadu

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Abstract- Thirty groundwater samples have been collected from VEPPANTHATTAI BLOCK, PERAMBALUR DISTRICT, TAMILNADU a purely hard rock terrain in south India for hydro chemical investigations to understand the chemical quality of the ground water. Most water quality parameters are not in the World Health Organization acceptable limits set for drinking water and also irrigation water quality found out by SAR, RSC, Sodium percentage using Piper, USSL diagrams.

Index Terms- Groundwater quality, SAR, RSC, Piper, USSL diagrams

I. INTRODUCTION

Water quality analysis is one of the important method used in groundwater studies. The hydro-chemical study reveals that the quality of water is suitable for drinking, agriculture and industrial purposes. It is also possible to understand the change in quality due to the interaction of rock water or any type of anthropogenic influence. Groundwater generally consists of seven major chemical elements i.e. Ca²⁺, Mg²⁺, Cl⁻, HCO₃⁻, Na⁺, K⁺ and So₄²⁻. The chemical parameters of groundwater play a significant role in classifying and accessing water quality. Considering the individual and paired ionic concentration, certain indices are proposed to find out the alkali hazards. Residual sodium carbonate (RSC) can be used as a criterion for finding the suitability of irrigation waters. It was observed that the criteria used in the classification of waters for a particular purpose considering the combined chemistry of all ions rather than individual or paired ionic characters. Chemical classification also throws light on the concentration of various predominant cations, anions and their interrelationship. A number of techniques and methods have been developed to

interpret the chemical data. Presentation of chemical analysis in graphical form makes understanding of complex groundwater system simpler and quicker.

II. OBJECTIVE

The objective of the present work is to discuss the major ion chemistry of groundwater of Veppanthattai block, Perambalur district. In this case the methods proposed by Piper, and USSL (US Salinity Laboratory) classification have been used to study critically the hydro-chemical characteristics of groundwater using for irrigation purpose.

III. STUDY AREA

Veppanthattai block is located in the Perambalur district in Tamilnadu state between 110 17' 00" to 110 31' 00" North latitude and 78°43' 00" to 78 58' 00" East longitude and covers an area of 415 sq.km with a population of 4,93,646 (as of 2001). The major sources of employment are agriculture, horticulture and animal husbandry, which engage almost 80% of the workforce. The major industries are that of chemicals,

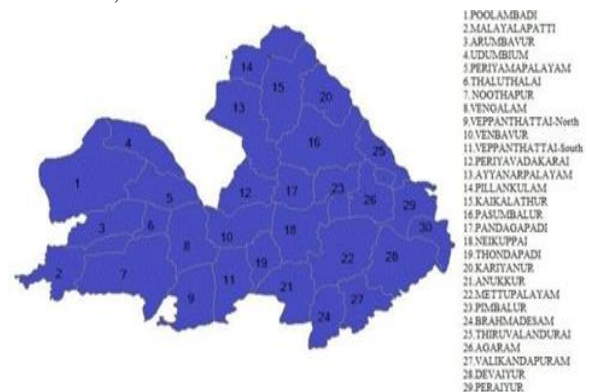


Fig.1: Sample collected area.

oil, cotton, soap, tools, food processing, rice mills, stone crushing and mining.

IV. RESULT AND DISCUSSION

GROUNDWATER SUITABILITY FOR DRINKING PURPOSE:

Physio-chemical properties of groundwater samples from different locations of Veppanthattai block in Perambalur district are shown in result.

pH:

It is clear from the table 1 that the pH value of water samples were varying from 6.65 to 7.81.

ELECTRICAL CONDUCTIVITY (EC):

EC of the groundwater is varying from 797 to 4910 mmhos/cm at 25°C. The maximum limit of EC in drinking water is prescribed as 2000mmhos/cm (WHO: 2006).

CARBONATE (CO₃²⁻) AND BICARBONATE (HCO₃⁻):

Carbonate is absent in all samples and Bicarbonate concentration are varying from 234 to 800 mg/l.

CHLORIDE (Cl⁻):

Chloride concentration was found to vary from 81 to 1010 mg/l. Chloride concentration was found to be very high (1010 mg/l). High concentrations of chloride give a salty taste to water. Taste thresholds for the chloride anion depend on the associated cation and are in the range of 200-300 mg/l for sodium, potassium and calcium chloride (WHO Guidelines, 2006).

SODIUM (Na⁺) AND POTASSIUM (K⁺):

Large amount of sodium gives salty taste when combined with chloride. Moderate quantities have little effect on the usefulness of water for most purposes. Sodium and potassium concentrations are varying from 80 to 522 mg/l and 12 to 185 mg/l respectively. Sodium imbalance in drinking water has been reported to cause a large number of lives threatening diseases. Hence, the excess consumption of sodium has been recognized as risk factor in hypertension (WHO Guidelines, 2006).

SULPHATE (SO₄²⁻):

Sulphate concentration was found to vary from 48 to 261 mg/l and these values are within permissible limits prescribed by ISI, ICMR and WHO.

NITRATE (NO₃⁻):

In the study area, nitrate concentrations were found to be higher level (>45mg/l). Out of 30 samples no

samples have exceed the permissible limit of nitrate. The high values of nitrates in the study area can be attributed to the excessive use of nitrogenous fertilizers for vegetables and other crops, and possibility of sewage contamination in groundwater. The primary health concern regarding nitrate and nitrite is the formation of methaemoglobinaemia, so called “blue-baby syndrome” (WHO Guidelines, 2006).

TOTAL DISSOLVED SOLIDS (TDS):

The total dissolved solids in water are represented by the amount of residue left when a water sample has been evaporated to dryness or it can be calculated from EC of water. TDS values varied from 558 to 3437 mg/l. Samples exceed the permissible limit prescribed by WHO.

TOTAL HARDNESS (TH):

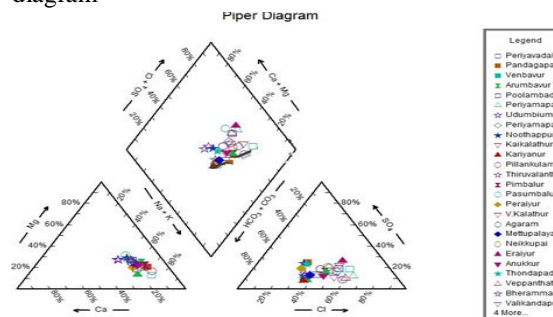
The hardness is an important criterion for determining the usability of water for domestic, drinking and other industrial supplies. Traditionally, hardness is a measure of the capacity of water to react with soap and form the Precipitate. Water hardness is caused by dissolved polyvalent metallic ions. In fresh water, the hardness causing ions are calcium and magnesium, which exists in the form of bicarbonates, chlorides, sulphates and nitrates (WHO Guidelines, 2006). The maximum permissible limit of total hardness for drinking water is specified as 200 mg/l. In the study area majority of the samples in the downstream part of river and irrigated area have exceeded the permissible limit of total hardness.

FLUORIDE (F⁻):

The fluoride content in the groundwater shows a range of 0.2 to 1.2 mg/l. In all samples fluoride concentration is in permissible limit. According to recommendation of WHO maximum permissible level of fluoride should be below 1.5 mg/l.

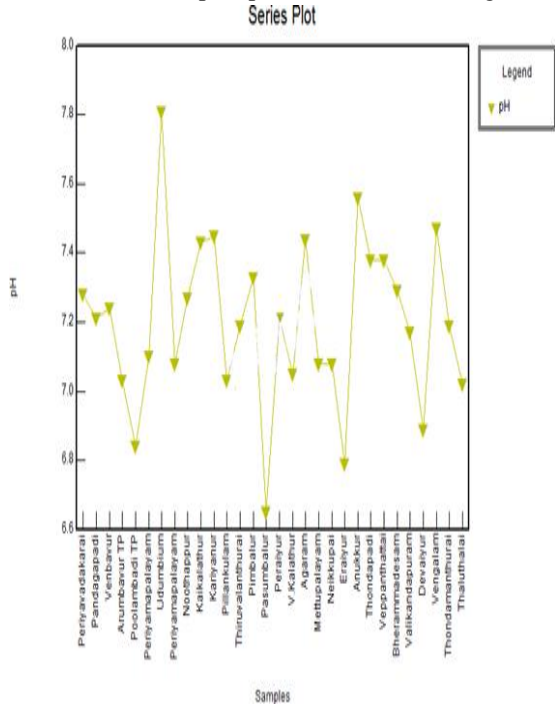
PIPER DIAGRAM:

Groundwater samples plotted in piper-Trilinear diagram

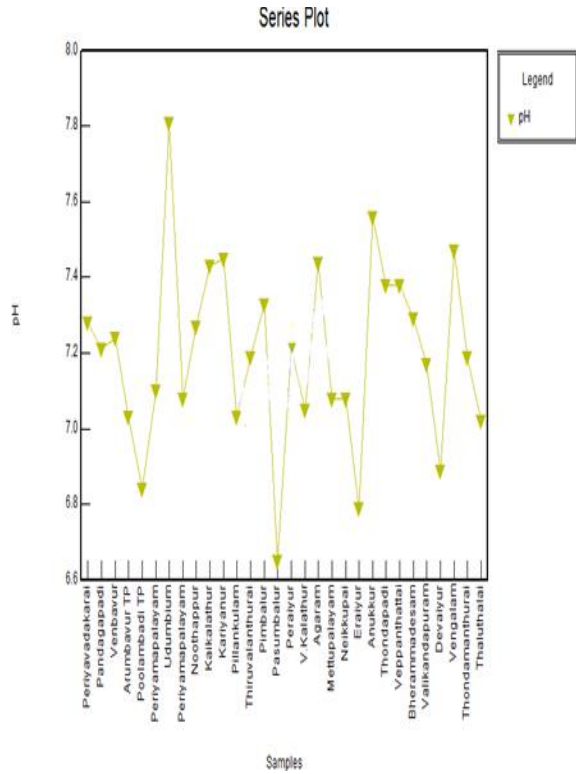


SERIES DIAGRAM:

Groundwater samples plotted in SERIES diagram



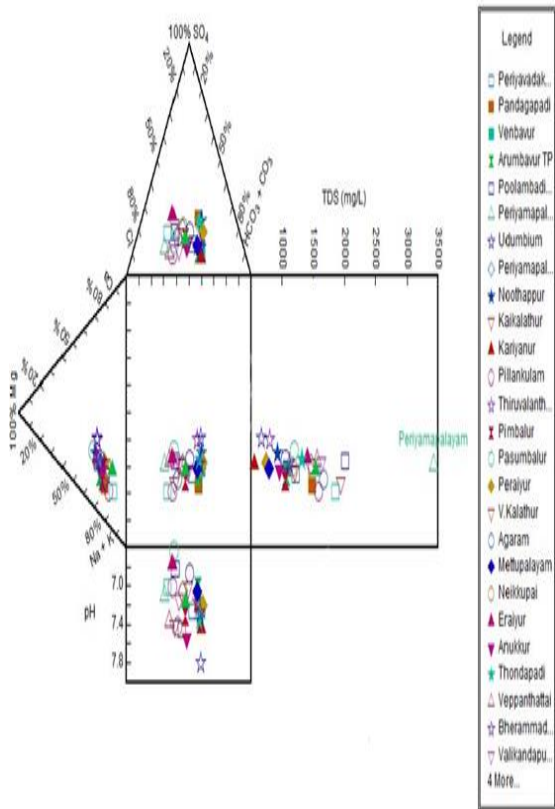
SERIES DIAGRAM



DUROV DIAGRAM:

Groundwater samples plotted in DUROV diagram.

Durov Diagram



SALINITY HAZARD:

For the purpose of diagnosis and classification, the total concentration of soluble salts (salinity hazard) in irrigation water can be expressed in terms of specific conductance. Classification of groundwater based on salinity hazard is presented in Table 6. It is found from the EC value. Only 7 samples were found to be unsuitable for irrigation purposes.

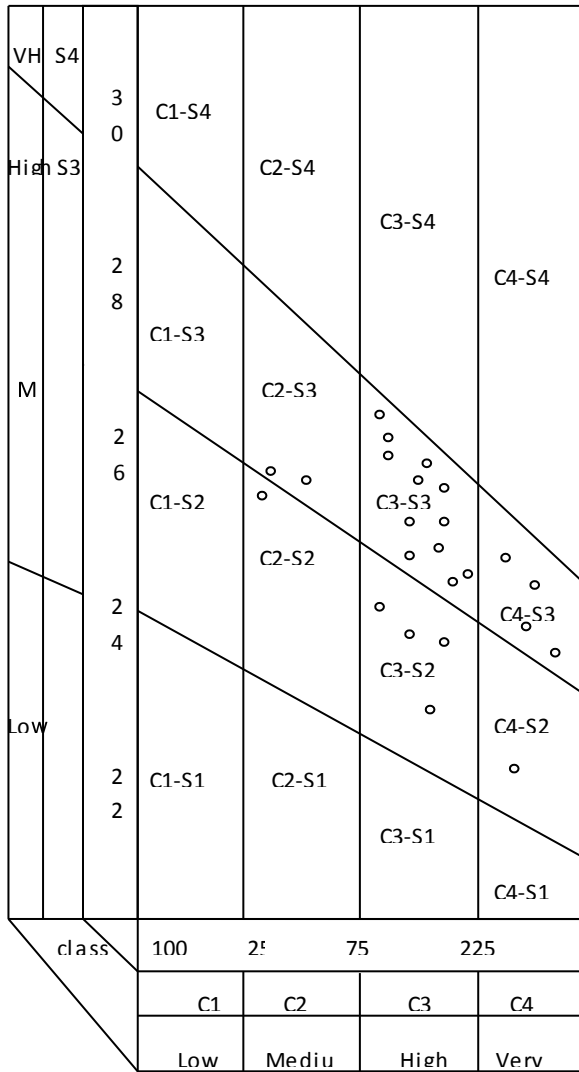
Table 1: salinity hazard classes

Salinity hazard class	EC in (micro moles / cm)	Remarks on quality	Pre-monsoon samples
C1	100 – 250	Excellent	Nil
C2	250 – 750	Good	Nil
C3	750 – 2250	Doubtful	797 – 2240 (23 samples)
C4& C5	>2250	Unsuitable	2270 – 4910 (7 samples)

USSL DIAGRAM:

In Veppanthattai block in perambalur, the groundwater is generally Na<Ca<Mg<HCO3 type.

100 2 3 4 5 6 7 8 9 1000 2 3 4 5000



V.CONCLUSION

Water qualities for drinking in this study area are nearly suitable only for 4 villages, remaining 26 villages are unsuitable. The total hardness (TH) of the study area were hard and very hard categories. For the irrigation purposes, the Na% is permissible for 2 samples only, and 25 samples are doubtful. The remaining 3 samples are unsuitable. The Residual sodium carbonate value is totally unsuitable for all 30 samples. The Sodium absorption ratio is good for 4 samples and doubtful for 9 samples, remaining 17 samples are unsuitable. Hence the Veppanthattai block's water qualities should manage properly by the way of reducing over exploitation of water and reduce the amount of fertilizer in agriculture field.

Also we suggested that the cultivation in this block to withstand high salinity crops.

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