# Hydrogeochemical Studies of Groundwater of Phagi Tehsil, Jaipur (Rajasthan), India

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***Abstract:*** **Groundwater quality of villages of Phagi tehsil was assessed during post-monsoon period to understand the contamination processes due to the presence of various contaminant sources. Water samples were collected during post-monsoon period [when a rise in water table was expected] followed by analysis for various physico-chemical parameters like pH, EC, TDS, total hardness, $Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, $Cl^{-}$, $HCO_3^{-}$, $SO_4^{2-}$. Comparison of values with World Health Organization (WHO) drinking water standards and other classifications show that present status of groundwater in Phagi tehsil is not so good for drinking purpose. Concentrations of major cations and anions in the groundwater systems vary spatially and temporally. Abundance of these anions is in the following order: $Ca^{2+}>Na^{+}>Mg^{2+}>K^{+}$ = $HCO_3^{-}>F^{-}>Cl^{-}>SO_4^{2-}>PO_4^{2-}$. In terms of rainy season impact, groundwater shows dilution and flushing. Samples show excessive leaching of different chemical components into groundwater system leading to the enrichment of different anions and cations indicating pollution from extraneous sources. The study on hydrochemical facies indicated that cations were dominated by sodium-potassium type while anions were dominated by carbonate-bicarbonate and chloride type ones.**

***Keywords: Contaminant Sources, Ggeochemical Processes, leaching, Physico-Chemical Parameters***

## I INTRODUCTION

There has been a tremendous increase in demand for fresh water due to population growth and intense agricultural activities. Quality of groundwater is equally important as its quantity owing to the suitability of water for various purposes. Variation of groundwater quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. [1] Ground water makes up about 20% of the world' s fresh water supply, which is about 0.61% of the entire world' s water, including oceans and permanent ice. [2] Poor quality of water adversely affects human health. [3] The present study has been conducted to determine concentration of hydrochemical constituents of drinking water sources of Phagi tehsil, Jaipur district, (Rajasthan) India. In the study, piper diagrams indicate the presence of major ions in water sources due to dissolution of mineral ions probably from rocks of mountains.

## II MATERIALS AND METHODS

*Study area:* Phagi tehsil is 51 km far from its district main city Jaipur. It has an average elevation of 383 m (1,257 ft). According to 2011 Census, there are 169 villages with 22,713 households having total population of 161,610 (with 52.12% males and 47.88% females) in Phagi Tehsil.

*Water sampling, preservation and data analyses:* A total 10 samples were collected from different wells, tube-wells or hand-pumps from 10 villages of Phagi Tehsil during post-monsoon period [From October 05 to 15, 2014]. All samples were labeled properly and according to the prerequisites for the analyses of samples. Temperature, pH, electrical conductivity, total dissolved solids, salinity were measured on site using potable meter (PCS Tester 35 Multi-parameter). All other parameters were analyzed according to the standard methods of APHA [4]. Sampling sites with source type are displayed in by using GIS software as shown in Figure 1 and Table 1.

Table 1: Source & location of samples of different villages of Phagi Tehsil

| Sample No. | Sampling Source | Village | Sample No. | Sampling Source | Village |
|---|---|---|---|---|---|
| P1 | Tube Well | Chittora | P6 | Well | Mohanpura |
| P2 | Hand Pump | Choru | P7 | Tube Well | Nimeda |
| P3 | Hand Pump | Didwata | P8 | Tube Well | Parwan |
| P4 | Tube Well | Ladana | P9 | Hand Pump | Phagi |
| P5 | Hand Pump | Lasariya | P10 | Hand Pump | Renwal |


Figure 1: Map of Phagi tehsil with sampling sites

## III RESULTS AND DISCUSSION

Some of the analyzed physico-chemical parameters of collected groundwater samples from different villages of Phagi district have been well described. [5] A few statistical details are discussed in this paper.

Water quality classification using piper trilinear diagram. In this study different hydro-chemical parameters of the groundwater were represented by plotting on a Piper tri-linear diagram (Figure 2). Piper trilinear diagrams (Piper, 1944) were prepared to classify the water quality of selected sources of study area. [6] The Piper diagram includes two triangles to represent cations and anions respectively and one diamond shaped area to represent combination of anions and cations. From this plot the concept of hydrogeochemical facies can be formulated. [6] The diagram classified the hydrochemical facies in account of prominent ions contributed the water quality. These diagrams graphically represent the chemical equilibrium between cations ($Ca^{2+}$, $Mg^{2+}$, $Na^{+}$ and $K^{+}$) and anions ($Cl^{-}$, $SO_4^{2-}$, $CO_3^{2-}$ and $HCO_3^{-}$) in water samples and also describe the presence of main contributor ions and chemical reactions taking place in the water. The study of hydrogeochemical facies can be used as a useful tool to determine the flow pattern, rock-water interaction and origin of chemical history of groundwater. From the Piper diagram, it can be interpreted that cation concentration of the groundwater samples of the selected area is predominated by sodium-potassium type, whereas anion concentration is dominated by carbonate-bicarbonate type and chloride type. [7]

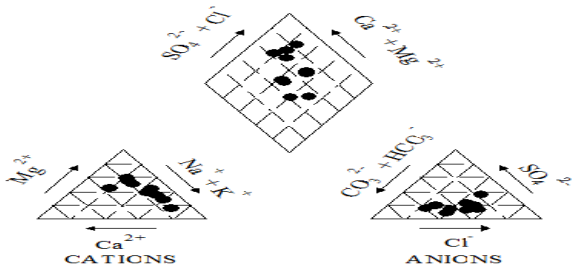


Figure: 2 Piper trilinear diagram of major ion geochemical post-monsoon period

## IV CONCLUSION

The quality of groundwater varies from one season to another season due to the rainfall of the region. The water quality of groundwater sources of study area has been assessed for drinking uses by analyzing various physico-chemical parameters during post-monsoon season. Piper diagrams indicate that cation concentration of the groundwater samples of the selected area is predominated by sodium-potassium type, whereas anion concentration is dominated by carbonate-bicarbonate type and chloride type. The results of indicate less suitability of all selected water sources for drinking purposes. So, regular monitoring is required to determine the pollution load as well as permanent remedial measures needed to be taken as a follow up like treatment of water to improve the water quality.

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