

EVALUATION OF GROUNDWATER QUALITY FOR DRINKING AND AGRICULTURE USES: A CASE STUDY OF NAGARKURNOOL WATERSHED, TELANGANA STATE

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Abstract

The groundwater quality evaluates its suitability for drinking and agricultural purposes in the watershed region of Nagarkurnool district. Twenty three groundwater samples were collected and analyzed for physico-chemical parameters such as pH, Total Dissolved Solids, Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, HCO₃⁻, CO₃²⁻, SO₄²⁻, NO₃⁻ and F. Based on analytical results, the hydrogeochemical facies showed dominant Na-Mg-Ca-HCO₃-Cl and mixed Na-Ca-Mg-Cl groundwater types. Water Quality Index of the study area shows that overall 30% of groundwater samples are of poor quality while the remaining are of excellent to good class. Factor analysis indicates that hydrogeochemical processes like weathering, ion exchange and anthropogenic activities have contributed to groundwater chemistry. The sodium percentage in the study area is of excellent to good categories except for 20% of groundwater samples that are doubtful to unsuitable types. US Salinity Index of the analyzed groundwater samples shows high salinity and low sodium. Based on irrigation water quality sodium adsorption ratio, residual sodium carbonate, Kelle's ratio, magnesium hazard and permeability index were assessed.

Keywords: Water quality index, Piper, Factor analysis, Drinking and Irrigation

1. Introduction

Groundwater is the alternate source in the absence of surface water bodies for its utility for different purposes (Edukondal et al. 2022). Unfortunately, technological advancement, urbanization, population growth and mismanagement in proper utilization of the available resources have resulted in the deterioration of groundwater both in terms of quality and quantity (Li et al., 2017). Under normal conditions, the quality of groundwater is influenced by geochemical processes such as weathering of minerals, precipitation, dissolution, ion exchange, oxidation-reduction and residence time of groundwater (Rina et al., 2013). Apart from this, human activities like excessive use of fertilizers, increase in pumping and discharge of industrial effluents alter the composition of groundwater (Hamilton and Helsel, 1995). Groundwater quality and human health are closely related and consumption of contaminated water has an adverse effect on human health. Determination of physical, chemical and bacteriological properties is essential for evaluation of groundwater quality for different purposes as per the water quality standards laid by different agencies (CGWB, 2010).

Hydrochemical evaluation of groundwater systems is based on the availability of a significant

amount of information concerning groundwater chemistry (Aghazadeh and Mogadam, 2004; Purushotham et al., 2011; Machender et al., 2014; Laxman Kumar et al., 2015, 2019; Satyanarayana et al., 2017). The quality of groundwater is equally essential as its quantity owing to the suitability of water for various purposes (Schiavo et al., 2006; Subramani et al., 2005). Groundwater chemistry in turn, depends on factors, such as geological setting, the degree of chemical weathering of various rock types, quality of recharge water and inputs from sources other than water-rock interaction. Such factors and their interactions result in complex groundwater quality (Purushotham et al., 2011). Groundwater is a valuable water resource for drinking, agriculture and industrial uses in the study area. In this study, physical, hydrogeological, and hydrochemical data generated from the analyzed groundwater system is integrated and used to determine the main factors and mechanisms controlling the chemistry of groundwater in the area (He and Wu, 2019a, b).

Assessment of groundwater quality has prompted this study related to the quality variations in the Nagarkurnool Watershed boundary in Nagarkurnool District. Twenty three groundwater samples were collected from hand pumps and bore wells in the vicinity

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