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Groundwater quality assessment using water estimation indices in Bokaro

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Bokaro district of Jharkhand State, which lies between 23°24'27"N to 23°57'24"N latitude and 85°34'30"E to 86°29'10"E longitude, is a highly industrialized and coalfields district of Eastern India. The objective of this study is to examine the groundwater quality assessment by laboratory methods with suitable interpretation through statistical analysis. Fifty-one groundwater samples were collected to analyze the various physicochemical parameters and heavy metals in the study area during the pre-monsoon season (May 2015). Water estimation indices and a number of statistical approaches such as geostatistics are useful to assess the groundwater quality in the study area, which is a main factor for controlling the groundwater in term of drinking purposes. The study reveals that EC, TDS, Ca²⁺, Mg²⁺, TH, Na⁺, NO³⁻, F⁻, HCO³⁻, Fe, Mn and Ni values of the few groundwater samples have exceeded as per the Bureau of Indian Standard (2012) and World Health Organizations (2006) standards. Groundwater Quality Index (GWQI) reveals that about 50.98% of the groundwater samples were belonging to the poor-quality water for drinking purposes. The Heavy metal pollution index (HPI) and Degree of contamination (Cd) have shown that most of the groundwater samples belong to the high-level category. Though, Cd provides the better alternative than any other indices. Principle Component Analysis (PCA) shows that the groundwater quality is mainly controlled by the rock weathering phenomena, ion exchange processes with minor contributions from anthropogenic activities of the study area. Subsequently, the results of cluster analysis (CA) and correlation matrix (CM) are also steady with the PCA outcomes. The spatial distributions map of GWQI, HPI and Cd are determined by geostatistical analysis and shows that high values of GWQI, HPI and Cd are mostly in the northeastern parts of the district as compared to the few samples of the northwestern part as well as the central part of the district. This indicates that the high values of the findings are due to various industrial, agricultural and urban activities in the area. It is expected that this study is helpful to know the groundwater quality status for effective management and utilization of the groundwater resources for decision makers who are taking proper measures for the supply of groundwater in the Bokaro district.

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