

## **Application of Multivariate Statistics and Hydro-Chemical Approach for Groundwater Quality Assessment: A Study on Birbhum District, West Bengal, India**

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**Abstract :** Groundwater quality deterioration due to human activities has become a prime factor of modern life. The major concern of the study is to access spatial variation of groundwater quality and to identify the sources of groundwater chemicals and its impact on human health of the concerned area. Multivariate statistical techniques, cluster, principal component analysis, and hydrochemical facies are been applied to measure groundwater quality data on 14 parameters from 107 sites distributed randomly throughout the Birbhum district. Five factors have been extracted using Varimax rotation with Kaiser Normalization. The first factor explains 27.61% of the total variance where high positive loading have been concentrated in TH, Ca, Mg, Cl and F (Fluoride). In the studied region, due to the presence of basaltic Rajmahal trap fluoride contamination is highly concentrated and that has an adverse impact on human health such as fluorosis. The second factor explains 24.41% of the total variance which includes Na, HCO<sub>3</sub>, EC, and SO<sub>4</sub>. The last factor or the fifth factor explains 8.85% of the total variance, and it includes pH which maintains the acidic and alkaline character of the groundwater. Hierarchical cluster analysis (HCA) grouped the 107 sampling station into two clusters. One cluster having high pollution and another cluster having less pollution. Moreover hydromorphological facies viz. Wilcox diagram, Doneen's chart, and USSL diagram reveal the quality of the groundwater like the suitability of the groundwater for irrigation or water used for drinking purpose like permeability index of the groundwater, quality assessment of groundwater for irrigation. Gibb's diagram depicts that the major portion of the groundwater of this region is rock dominated origin, as the western part of the region characterized by the Jharkhand plateau fringe comprises basalt, gneiss, granite rocks.

**Keywords :** correlation, factor analysis, hydrological facies, hydrochemistry

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