

CHARACTERIZATION & SPECIATION OF URANIUM IN GROUNDWATER SAMPLES COLLECTED FROM MONAZITE RICH EASTERN COASTAL REGIONS OF INDIA

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Abstract

Groundwater samples (from hand pump & borewell) were collected from a Natural High Background Radiation Area (NHBRA) to estimate the physicochemical parameters and uranium concentration. Ion Chromatography & LED Fluorimeter techniques have been used to measure the major ions and uranium concentration present in groundwater samples respectively. The estimated uranium concentration in the collected groundwater samples varied from 0.3 ± 0.1 to 16.4 ± 2.1 $\mu\text{g/l}$. Piper diagram was generated using the estimated major ionic concentration in the groundwater samples. Out of four major hydrochemical facies [i.e. (Na+K)-(SO₄+Cl) type, (Ca+Mg)-(SO₄+Cl) type, (Ca+Mg)-(CO₃+HCO₃) type, and (Na+K)-(CO₃+HCO₃) type], nearly 62 % of the samples are of mixed type, nearly 13% of the samples are calcium chloride type & 25% of the samples are sodium chloride type waters. Hydro-geochemical coefficients were calculated using the ionic composition of groundwater samples. The theoretical speciation calculation of uranium in groundwater samples was carried out using the geochemical modelling tool MEDUSA (Make Equilibrium Diagram Using Sophisticated Algorithm). Speciation analysis has revealed that the collected groundwater samples are enriched mostly with UO₂PO₄, UO₂CO₃, UO₂(OH)₃, (UO₂)₂CO₃(OH)₃ & UO₂⁺ complexes. From the study, it was observed that uranium concentration in groundwater is not significantly influenced with respect to the natural deposition of heavy minerals in the study area. The concentration of dissolved uranium in groundwater appeared to be controlled by pH, Eh, and anion field condition, rather than the solubility of uranium minerals.

Keywords: High Background Radiation Area, Groundwater characterization, Uranium Speciation, Hydro-Geochemistry, Medusa-Hydra Chemical Equilibrium Code.