

Geochemical Characterization and Health Risk Assessment of Groundwater in Sri Lanka

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This study evaluates the hydro-geochemical properties of water samples from various domains across climatic zones and geological complexes to determine water quality and potential health risks. Groundwater quality data are presented from a total of 1508 groundwater samples. Key parameters such as temperature, pH, total alkalinity (TA), total hardness (TH), electrical conductivity (EC), bicarbonate (HCO_3^-), sulfate (SO_4^{2-}), phosphate (PO_4^{3-}), nitrate (NO_3^-), chloride (Cl^-), fluoride (F^-), sodium (Na^+), potassium (K^+), magnesium (Mg^{2+}), and calcium (Ca^{2+}) were analyzed. The county's greatest median EC and TH values ($1350.29 \mu\text{S cm}^{-1}$ and 494.97 mg L^{-1}) might be sedimentary terrain. The greatest geographical changes in EC and TH values, which are probably influenced by climate, were found on the metamorphic terrain that makes up more than 90% of the island. The Water Quality Index (WQI) and Health Index (HI) were calculated to assess water usability and associated health implications. The results show significant variability in water quality across different zones. The dry zone exhibits higher mineral content and poor water quality, with domains like A having the highest WQI of 93.00 (Very Poor). The wet zone, particularly domain H, demonstrates the best water quality with a WQI of 9.00 (Excellent). Parameters like electrical conductivity, hardness, and chloride levels are elevated in the Sedimentary and Wannu complexes, indicating salinity and mineralization issues. The average pH (6.73) is within permissible limits, but acidity is noted in the wet zone Highlands (pH 4.73). Health risk assessments reveal that the dry zone poses the greatest health concerns, with a maximum HI of 5.36. The findings highlight the need for targeted water management strategies, including salinity control in the dry zone, enhanced mineral content monitoring, and water quality maintenance in the wet zone. This study underscores the importance of region-specific interventions to ensure safe and sustainable water resources.

Keywords: Electrical conductivity, hazard Index, total alkalinity, total hardness, water quality Index