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Integrated Geospatial Analysis for health risk assessment of Geogenic Contaminants in Drinking Water Sources

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Groundwater quality is a major concern in developing countries, where numerous contaminants infiltrate drinking water systems from various sources. Arsenic (As) is one such carcinogenic toxin that enters groundwater, posing severe health risks. This research was conducted in a southern coastal district of India, where we assessed the population at risk due to direct ingestion of As through drinking water. The concentration of arsenic (As) in the water samples ranged from 0.029 µg/L to 14 µg/L. Over 25% of the samples exceeded the permissible limit of arsenic in drinking water, as specified by Indian standards. An integrated geo-spatial model successfully identified contaminant hotspots and the vulnerable population. Carcinogenic health risks in high-risk areas were evaluated using EPA guidelines. The Hazard Index (HI) revealed that HI values were higher for children (HI=1.24) compared to adults (HI=0.659) in the study area. This emphasizes the importance of closely monitoring the groundwater status in the region. Source assessment through Principal Component Analysis (PCA) and Cluster Analysis (CA) indicated that As originates from geogenic sources. This finding was further validated using Geographic Information Systems (GIS).

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