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Hydro-geochemistry of Dhanbad District, Coal City of India: Source Evaluation and Quality Assessment

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Dhanbad is actively associated with mining activities for more than a century and known as coal city of India. More than 200 coalmines including famous Jharia coalfield, which produce prime coking coal, are located in and around Dhanbad town. Besides, active open cast and underground mine, there are more than hundred abundant coal mines and associated dormant overburden dumps. The presence of active and abundant coal mines, overburden dumps, thermal power plants, coal washeries, coking coal plants and other coal based industries including refractories, steel, fertilizer and cement plants poses serious threats to the quality of available water resource of the area. In the present study, detail investigation of water chemistry of surface, subsurface and mine water of the Dhanbad district has been carried out to know the hydrochemical characteristics of the area.

Surface, subsurface and mine water collected from rural, urban, industrial and mining areas of Dhanbad district have been analysed to assess the major ion chemistry, the weathering and geochemical processes controlling the water composition and suitability of water for domestic, industrial and agricultural uses. Ca, Mg, and HCO3 dominate the chemical composition of the water chemistry. However, in the mine water and water samples collected from mining areas, high concentration of SO4 has been observed. Water chemistry of the study area strongly reflects the dominance of continental weathering and higher concentration of SO4, Cl and TDS in some samples indicates mining and anthropogenic impact on water quality. The high contribution of (Ca+Mg) to the total cations, relatively high (Na+K)/TZ+ ratio (0.27) and low equivalent ratio of (Ca+Mg)/(Na+K) i.e. 3.6 suggest combined influence of carbonate and silicate weathering. The higher values of C-ratio for most of the surface and subsurface water signify that carbonic acid weathering is the major proton producer in these waters. However, the low C-ratio for the mine water (average 0.22) and the waters collected near the coal mining areas suggests that sulphide oxidation and/or coupled reactions (involving both carbonic acid weathering and sulphide oxidation) control the chemical quality in the mining areas. The quality assessment of surface and subsurface water shows that water is suitable for domestic use with few exceptions. The calculated values of SAR, RSC and sodium percentage indicate that water can be used for irrigation without any hazard.