Hydro-chemical and stable isotope ($\delta^{18}O$ and δD) to study groundwater contamination in the overexploited aquifers of Indo-Gangetic Plain, a part of NCR, Delhi

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Abstract

Inadequate availability of surface water supply, vagaries of monsoonal rainfall and overexploitation due to population pressure and rapid landuse change induced decline in groundwater levels and salinization has been observed in many Asian megacities. Millions of people in these urban settlements rely on groundwater for fulfilling daily water needs due to lack of public water supply and infrastructure. Many of these megacities in are situated on alluvial plains which are more susceptible to contamination also. After green revolution, large part of Indo-Gangetic plain groundwater salinization and contamination has been reported. One such region is National Capital Region, Delhi- India's largest and the world's second largest agglomeration of people and economic hub of Northern India. The present study includes National capital territory, Delhi, Gurgaon and Faridabad. In the present study, different graphical plots, Piper plot, saturation index values (using PHREEQC), stable isotopes ($\delta^{18}O$ and δD) and GIS is used to create the database for analysis of spatial variation in respective water quality parameters as well as to decipher the hydrogeochemical process occurring in the area. Major ions are analyzed to describe the composition and distribution of contamination and dissolution/precipitation dynamics. It was observed that besides weathering, semi-arid climatic condition induced evaporation is also playing a major role in groundwater chemistry of the area. $\delta^{18}O$ and δD regression line of groundwater samples of the study area is below the LMWL also suggest from non-equilibrium fractionation during evaporation. The wide range (0.1-16.0 ppm) in fluoride concentration suggests contribution from both point and non-point sources. Large lateral variation in chloride concentration suggests impact of evapotranspiration rate during recharge. Most of water facies are of Na-Cl. Stable isotope ($\delta^{18}O$ and δD) analysis helps to identify evaporation and to better understand recharge processes and mixing dynamics in the study region. Limited availability of surface water supply, no pricing

exists for groundwater extraction has resulted in a widespread decline in the water table and intermixing of fresh and contaminated water. The freshwater crisis in this area can be managed by the strict enforcement of regulatory measures restricting unplanned and indiscriminate water abstraction and fertilizer application as well as waste disposal from industries.

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