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STABLE ISOTOPE TECHNIQUE TO DISCERN SOURCE AND ORIGIN OF CONTAMINATION IN GROUNDWATER OF BANGALORE CITY, KARNATAKA, INDIA

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It is possible to determine the source and origin / recharge of ground-water, geochemical processes in the aquifer system and major locations of recharge zones using data on stable isotopes. Lake (n=9), sewage (n=19), rain (n=11) and groundwater (n=43) samples were collected during different seasons of the year 2008 and 2009. Measurements of the stable isotope (viz., δ^{18}O and δ^{2}H) composition of sewage water samples along lake, rain and groundwater samples were made after applying correction factors to ascertain interaction and interrelationship between groundwater and sewage, rain water and surface water bodies, lake and groundwater. δ^{18}O values for groundwater samples varied from (-6.0) to (-2.3) ‰ and (-5.9) to (-1.9) ‰ respectively during pre- and post-monsoon seasons of 2008, with average values of (-3.83 ‰) and (-3.28 ‰). δ^{2}H values groundwater samples varied from (-25.4) to (-0.8) ‰ and (-24.2) to (-1.1) ‰ respectively during pre- and post-monsoon seasons of the year 2008, with mean concentration of (-11.46 ‰) and (-14.26 ‰). Similarly, in the case of sewage samples, δ^{18}O values were (-3.5) to (-2.0) ‰ and (-3.3) to (-1.7) ‰ respectively during pre- and post-monsoon seasons (averages: -2.54 and -2.43 ‰) and δ^{2}H values were (-14.0) to (-0.2) ‰ and (-22.7) to (-1.4) ‰ for pre- and post-monsoon seasons (averages: -6.06 and -12.25 ‰). In case of lake samples, δ^{18}O values were (-3.4) to (-0.0) ‰ and (-2.7) to (-0.2) ‰ respectively during pre- and post-monsoon seasons (averages: -1.7 and -1.3 ‰) and δ^{2}H values were (-15.3) to (-0.4) ‰ and (-15.5) to (-3.3) ‰ for pre- and post-monsoon seasons (averages: -8.5 and -10.8 ‰). In rainwater samples, δ^{18}O values and δ^{2}H values varied from (-8.36) to (-0.97) ‰ and (-54.38) to (-4.74) ‰, with their respective mean concentration of (-5.62 ‰) and (-31.53 ‰).

The linear equation for the pre monsoon ($\delta D=2.11*^{18}O - 7.34$) and post monsoon ground water samples ($\delta D=5.08*\ ^{18}O + 7.97$) confirms depleted isotopic signature than the LMWL (Local Meteoritic Water Line). The aquifer highly appears to be influenced by the complex system of surface water sources and precipitational events thereby heavily affecting the isotopic composition of the groundwater. The groundwater flowing along the different valleys is greatly influenced by the sewage network as indicated by the clustering of sewage sample and groundwater isotopic signatures. Moreover, the "sewage influence signature" correlated with the sewage influences group extracted from the physico-chemical parameters. The measurement of the stable isotope composition in lakes corroborated with the rain. Majority of these isotopic values were distributed on both sides of the GMWL and LMWL, those found below the LMWL indicate the possible source of precipitation water and those above the LMWL is from the groundwater resources. The lakes are in tune with the precipitation as well as the groundwater and thus, a mixed trend or diffused origin of this water is noticed. However, most of the pre monsoon sewage samples data converged around the LMWL confirming the influence of rain water in the sewage flow, as runoff water while that of post monsoon showed a depleting trend suggesting the stagnant flow occurring in the sewage channel.

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