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Assessment of geospatial and hydrochemical interactions of groundwater quality, southwestern Nigeria

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Abstract Groundwater pollution resulting from anthropogenic activities and poor effluent management is on the rise in Nigeria. Hence, groundwater used for domestic purposes is questionable and therefore calls for scientific scrutiny. Investigation of hydrochemical interactions and quality of groundwater resource is essential in order to monitor and identify sources of water pollutants. As a result, groundwater samples were collected from 21 locations in Abeokuta South, Nigeria and analyzed for physicochemical parameters using standard methods. Results obtained were subjected to hydrochemical and geospatial analyses. Water quality parameters investigated exhibited wide variations from location to location. Fe^{2+}, Mg^{2+}, SO_4^{2-}, Cl^-, total hardness (TH), Mn, Na^+, NO_3^-, SiO_2, and alkalinity exhibited the highest levels of variation with coefficients of variation of 131.3, 92.8, 83.9, 76.7, 65.9, 64.3, 57.6, 57.2, 57.0, and 52.5, respectively. The average pH value was 6.76 with 71% of the water samples being slightly acidic. Na^{2+}, Mg^{2+}, Fe^{2+}, and EC contents exhibited the most violation of drinking water standards with percent violations of 100, 52.4, 47.6, and 47.6%, respectively. Parameters, such as Mn, Ca^{2+}, NO_3^-, and CO_3^{2-}, were within the WHO guideline values for drinking water in all the samples. The highest level of significant correlation was found to exist between Na^+ and Cl^- ($r = 0.84$, $\alpha = 0.01$). Six principal components, which explained 83.5% of the variation in water quality, were extracted with the first (34.1%) and second components (15.7%) representing the influence of mineral dissolution and anthropogenic practices, respectively, on the hydrochemistry of the area. Four hydrochemical clusters were identified with distinctly partitioned water quality. Further analysis revealed that 38, 29, 24, and 9% of the samples were the Na-K-HCO_3, Na-K-Cl-SO_4, Ca-Mg-HCO_3, and Ca-Mg-Cl-SO_4 types, respectively. Anthropogenic activities are increasing threat to groundwater quality in the study location and therefore call for urgent attention. There is also a need for routine monitoring of groundwater in Abeokuta.

Keywords Groundwater · Abeokuta · Hydrochemical · Pollution · Geospatial · Southwestern Nigeria

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