

The Tracing of Groundwater Contamination Sources in Indonesian Coastal Alluvial Groundwater using $\delta^{34}\text{S}$ and $\delta^{15}\text{N}$ Isotopes

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The coastal area is one of the Indonesian Government priorities as an archipelago country. The groundwater in the area is one of the most reliable clean water resources, therefore it is crucial to understanding the vulnerability of this resource. Our research area was located at Indramayu, a developing rural coastal area in Indonesia, where, the environment was relatively pristine. This research aimed was to identify the effect of natural condition and human activity to groundwater quality by using stable isotope $\delta^{34}\text{S}$ and $\delta^{15}\text{N}$.

Totally, there were 20 samples taken from groundwater (18) and river (2). The nitrate and sulfate were detected in a total of 5 and 19 samples, respectively. The isotopes composition for isotope nitrate were -11.2‰ – $+22.22\text{‰}$ for $\delta^{15}\text{N-NO}_3$ and -3.4‰ – $+17.1\text{‰}$ for $\delta^{18}\text{O-NO}_3$. Moreover, the values of $\delta^{34}\text{S-SO}_4$ and $\delta^{18}\text{O-SO}_4$ were varied from -4.2‰ – $+28.4\text{‰}$ and $+7.3\text{‰}$ – $+18.8\text{‰}$, respectively. The isotopic signatures of nitrate suggested that the used of inorganic fertilizer and animal manure give the impact to both groundwater and river. Similarly, the isotopic signatures of sulfur were showing that those detected sulfate in the groundwater were mostly coming from fertilizer. Moreover, the soil was mineralized by organic sulfate as well. At one point, located in the fishery area, the groundwater was indicated the seawater contamination. It was shown by the heavy composition of sulfur isotope (28.4‰ for $\delta^{34}\text{S}$ and 18.8‰ for $\delta^{18}\text{O}$). Lastly, our results showed those combined isotopes of $\delta^{34}\text{S}$ and $\delta^{15}\text{N}$ along with land-use evaluation could explain the possible sources of groundwater in coastal area at very early urbanization stage.

Keywords: Sulfur Isotope, Nitrate Isotope, Coastal Groundwater, Indramayu