

Dynamics of sulfate and nitrate inferred from stable isotope techniques in Chikusa river watershed, Hyogo Prefecture

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The Chikusa river watershed is located in the southwestern part of Hyogo prefecture. Recent river improvement in the watershed has posed concerns about changes in water quality and river ecosystem. This study aims to clarify the dynamics of dissolved ions especially sulfate and nitrate using stable isotope techniques, and to contribute to the evaluation of water environment in the watershed.

Water samples were collected from headwaters to the river mouth in August (2015, 2016, and 2017) and in February (2018), and measured ion concentrations, sulfur ($\delta^{34}\text{S}$) and oxygen ($\delta^{18}\text{O}$) stable isotope ratios of sulfate, and nitrogen ($\delta^{15}\text{N}$) and oxygen ($\delta^{18}\text{O}$) stable isotope ratios of nitrate.

Sulfate concentration was lower upstream and higher downstream in all periods, and the nearest point to the river mouth showed typically high concentration (1156 mg l^{-1}). The $\delta^{34}\text{S}$ and $\delta^{18}\text{O}$ values of sulfate suggested that the sulfate was mainly derived from soil sulfate, and the sulfate near the river mouth was derived from the seawater. In contrast, nitrate concentration was higher upstream and lower downstream in August, however the trend reversed in February. The $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ values of nitrate imply that the contribution of primary production and/or denitrification in water caused the reversed trend of nitrate concentration. The spatial distribution of $\delta^{15}\text{N}$ of nitrate showed a significant correlation with the proportion of fertilized land use (paddy field, farmland, and golf course) in all periods, suggesting an influence of fertilization.

Keywords: sulfate, nitrate, sulfur stable isotope, nitrogen isotope, oxygen stable isotope, Chikusa River watershed in Hyogo