

Nitrate degradation process in the coastal groundwater of Seto Inland Sea

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The authors conducted the study to demonstrate the nitrate ($\text{NO}_3\text{-N}$) degradation process in the coastal groundwater of Seto Inland Sea located on southwestern Japan. We examined this process based on the variations of $\text{NO}_3\text{-N}$, $\text{HCO}_3\text{-C}$, Cl- , DOC concentrations and ORP in groundwater of the study catchment. We also estimated the $\text{NO}_3\text{-N}$ discharge by groundwater to the sea. The results are summarized as follows: 1) $\text{NO}_3\text{-N}$ concentrations in the shallow groundwater were about 30mgL^{-1} in the midstream area of the catchment, whereas it decrease less than 2.0mgL^{-1} in the downstream area with groundwater flow. The inverse relationship between $\text{HCO}_3\text{-C}$ and $\text{NO}_3\text{-N}$ suggests biochemical denitrification process in the groundwater. This is also supported by the low ratio of seawater contribution (less than 1.0%), and relatively low ORP in the groundwater of the downstream area; 2) The $\text{NO}_3\text{-N}$ concentrations in the downstream area were relatively higher in high-flow than that in the low-flow season. These results suggest to be caused by the difference of groundwater velocity in the downstream area, suggesting that the effect of denitrification is larger in the low-flow than the high-flow season. These indicate that the discharge of $\text{NO}_3\text{-N}$ in the high-flow is larger than that in the low-flow season; 3) The relationship between oxygen stable isotopic ratio and $\text{NO}_3\text{-N}$ concentrations in the shallow groundwater and in the domestic wastewater suggest that the mixing with domestic wastewater leads to supply of DOC to the groundwater, and consequently increase in denitrification process in the shallow groundwater than the deep groundwater; 4) Based on these results, we estimated the $\text{NO}_3\text{-N}$ discharge by groundwater to be about 5.0% of the annual nitrogen input to the study catchment from fertilizer application.