



Identification of sources and behavior of agricultural contaminants in groundwater using nitrogen and sulfur isotope in Haean basin, Korea

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The Haean basin shows a bowl-shaped topographic feature and the drainage system shows a dendritic pattern. The study area is consisted of forests (58.0%), vegetable fields (27.6%), rice paddy fields (11.4%) and fruit fields (0.5%). Most of residents in the study area practice agriculture and paddy rice and vegetables (Chinese radish) are the typical crops grown. The concentration of nitrate in groundwater showed 0.8 ~ 67.3 mg/L in June, 2012 and 2.0 ~ 65.7 mg/L in September, 2012. Hydrogeochemical values and stable isotope ratios of dissolved nitrate and sulfate in groundwater were used to identify contamination sources and transformation processes in shallow groundwater. The $\delta^{15}\text{N-NO}_3^-$ values in the study area ranged between +5.2 and +16.9‰ in June and between +4.4 and +13.0‰ in September. The sulfate concentration in groundwater samples obtained from the study area varied from 0.8 to 16.5 mg/L in June and 0 to 19.7 mg/L in September. $\delta^{34}\text{S-SO}_4^{2-}$ values ranged from +2.9 to +11.7‰ in June and +1.6 to +8.2‰ in September. The values of $\delta^{15}\text{N-NO}_3^-$ and $\delta^{34}\text{S-SO}_4^{2-}$ in September were slightly decreased than those of values in June. The chemical composition of groundwater in vegetable and fruit fields showed slightly lower values of $\delta^{34}\text{S-SO}_4^{2-}$ and $\delta^{15}\text{N-NO}_3^-$ indicated that a mixture of synthetic and organic fertilizers is responsible for groundwater contamination with agro-chemicals. Most groundwater from forests and paddy fields showed slightly higher values of $\delta^{15}\text{N-NO}_3^-$ suggested that organic fertilizer is introduced into subsurface.