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Characteristics of contamination and attenuation of nitrate in groundwater with different scale of flow system

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For the sustainable use of groundwater resources for the future, it is important to clarify the characteristics of nitrate contamination and natural attenuation (e.g. denitrification) in an aquifer. In recent years, several researchers have suggested that landscape hydrogeology can provide an important framework for understanding nitrate removal capacity at the riparian zones. However, few studies discussed about the relation between groundwater flow condition and nitrate attenuation process on the catchment scales. The objective this study is to confirm the characteristics of nitrate contamination and attenuation in the groundwater with the different scale of flow system. We compared the data on the groundwater flow, nitrate concentration and nitrogen stable isotope ratio (d15N) in groundwater in the three study sites (IK, YD and JK). All these study areas are characterized by the large nitrogen load from agricultural, domestic and industrial activities. The IK (Ikuchijima) aquifer is located in southern Japan with the catchment area of 44ha and topographic gradient of 1/50. The YD (Yellow River Delta) aquifer is located on the lower reaches of the Yellow River, which covers approximately 5200km² and topographic gradient is approximately 1/1000. The JK (Jakarta) aquifer is located on the metropolitan area of Jakarta that is lower reaches of the Ciliwung River catchment and the topographic gradient is approximately 1/400.

In the all study sites, groundwater in the recharge area is characterized by relatively high concentrations of NO₃-N and relatively low d15N. Especially in the IK and YD, NO₃-N concentration exceeds 20mgL⁻¹. However, NO₃-N concentration decreased and d15N increased along with groundwater flow in all study area. These results suggest that NO₃-N attenuation by the processes of dilution and denitrification occurs. Especially in the YD, isotope enrichment ratio is higher than the other two sites (IK & JK). NO₃-N attenuation potential is estimated to be YR >JK >IK based on the geological condition, groundwater velocity and isotope enrichment ratio.

Keywords: groundwater, nitrate, contamination, attenuation, different scale of flow system