How do the groundwater recharge affects nitrate-nitrogen loadings?

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Groundwater is being utilized drinking water in the world. However, the widespread contamination of groundwater with nitrate was occurred which is one of the major problems. Generally, shallow groundwater in the alluvial fan is recharged by river and the rain water (Mizutani et al., 01). In particular, rainfall is one of the principle sources of groundwater recharge in alluvial fans and rainfall infiltrated is regarded as careers of nitrate nitrogen into the groundwater (Ogawa et al., 01).

The objective of this paper is to identify the source and transport of nitrate in groundwater using stable isotopic techniques. The recent study reported that the groundwater aquifer of the Kofu basin was contaminated from nitrate (Kazama et al, 02). This study focused on the Midai and Kamanashi fans in the western Kofu basin, located in Yamanashi-pref. These fans were formed by two rivers namely Midai and Kamanashi Rivers. Groundwater samples (n=80) were collected from domestic and farm wells distributed over an area during 22-29 May, 03. The bi-monthly river water samples were collected from Midai and Kamanashi rivers and the monthly precipitation samples collected on the basin during May, 03- May, 04. Spring water samples were collected bimonthly from June, 03-June, 04 at two locations on Mt.Tuku. Water samples were analyzed for major cations, anions and isotopes (Water-d18O and Nitrate-d15N).

Through the cluster analysis on cations and anions parameters, two groundwater aquifers formed on the Midai and Kamanashi fans were identified in the basin. The nitrate concentration were observed 0-46.8ppm and 0-18.3ppm in the Midai and Kamanashi fans respectively. And the range of d15N value are +3˜+9‰ in the both fans, and these values gave agreement with the value that had been obtained by previously reported. It suggests that the major sources of nitrate are inorganic and organic fertilizers.

The bi-monthly d18O values for Midai (-11.1(+-)0.4‰) and Kamanashi (-11.0(+-)0.3‰) rivers did not show the wide variations. The mean values d18O of spring water at Mt.tuku (-9.7(+-)0.1‰) was similar to the weighted mean values of d18O of precipitation (-9.5(+-)2.2‰). This indicates that the precipitation is a source of spring water at Mt.Tuku. However, the contrast between the wide range values observed in precipitation and the narrow range values in spring water at Mt.Tuku suggests the mixing occurred while infiltration to groundwater. A similar finding was also reported in Mizutani et al. (01).The d18O range of groundwater were -11.1˜-10.0‰, it suggest the origin of groundwater were precipitation and river water.

In both aquifers, the strong positive correlation was observed with nitrate concentration increased with the increasing of d18O values. These relationships were showed that precipitation infiltration act as a carrier and river water infiltration act as dilution role in loading of nitrogen into the groundwater.It is also observed that the slope of regression line is almost double in case of Midai to Kamanashi. This can be attributed to the land use types of the respective aquifers. The dominant land use types of Midai and Kamanashi aquifers are orchard (over64 %) and paddy fields (over51%) and farmers apply fertilizers @12 and 2.5 kgN/ha/yr respectively.

Therefore it can be concluded that nitrate loading was not only affected by the land use types but also the mixing ratio between precipitation and river water in groundwater.

Reference

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