The nitrogen loading in to the river on the alluvial fan from non-point sources

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Groundwater as well as surface water is found contaminated by nitrate-nitrogen around the world. The basic sources of the nitrate-nitrogen to the river water are considered as run off water from the agricultural land, forest areas, industrial and city waste water. However, many studies has been carried out focusing on the point source nitrate pollution, where as non point source are not fully studied. Non point source represents a wide variety of sources rather than a single origin or source. The study focused on the identification of the non point nitrate-nitrogen sources in Ukai watershed, which was carried out by using nitrate-nitrogen isotope ratio, with the hydrological data and water chemistry parameters.

Ukai watershed is characterized as mountainous area towards the up stream which flow in to the basin area. The basin area is consisting with compound alluvial fans. The watershed comprises farm areas with composite land use, especially the areas are used for peach and grape cultivation. In addition to the agricultural areas, the watershed also possesses urban areas; Enjan and Fuefuki city.

Sampling of river water was taken during the stormflow and baseflow conditions at Ukai station to assess the source of surface and sub surface of nitrate-nitrogen respectively. Similarly, shallow well waters were sampled from farm areas by considering the possibility of nitrate coming from the farm areas, due to fertilizer application. Furthermore, drainage water was collected at Enjan and Fuefuki city where as; the up stream water were collected from the mountainous areas of Ukai watershed. All the water samples were analyzed for nitrate-nitrogen isotope and major dissolved ions.

The average value of nitrate-nitrogen isotope at the up stream river water samples were +3.6(+-) 0.4‰. The similar range of isotope value was reported from the mountainous soil nitrogen (Kendall, 1998). It suggests that the soil from mountainous regions is contributing for nitrogen to the upstream river water. The average nitrate-nitrogen isotope values of groundwater samples were +7.5(+-) 1.7‰, this value corresponds to the range of nitrate-nitrogen isotope of the fertilized soil (Kendall, 1998). It suggests source of nitrate-nitrogen to those groundwater are from the fertilized areas. The average value of nitrate-nitrogen isotope in drainage water was +12.6(+-) 2.0‰ which lies in the similar range of nitrate-nitrogen isotope value in drainage water (MOE, Japan. 2002).

In this study, isotopes of nitrate and ratio of Na+/Cl-, clearly differ among the each source of nitrate-nitrogen. Furthermore, analyses of nitrate-nitrogen isotope with major water quality parameters were important for differentiating the possible source of nitrate in UKai watershed. The baseflow samples were characterized by relatively high nitrate-nitrogen isotope values and low Na+/Cl- ratio and vice versa in stormflow samples. This pattern strongly suggests that the baseflow samples, whose values were in between groundwater and drainage samples, are actually a mixture of groundwater and drainage waters. During the baseflow condition, the source of nitrate nitrogen was found from the agricultural area (fertilizer application) and drainage. In other hand, the storm flow value which was intermediate with groundwater and upstream water sample values that suggest during storm flow nitrate is deriving from the groundwater as well as upstream (mountain soil) of Ukai watershed.

Reference

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