Analysis of Nitrogen Pollution of Ground water in Kathmandu Valley

*Masanari Morita[1], Bijay Man Shakya[1], Suresh Das Shrestha[2], Takashi Nakamura[3], Kei Nishida[3]

1. Special Educational Program on River Basin Environmental Science, University of Yamanashi , 2. Central Department of Geology, Tribhuvan University, 3. Interdisciplinary Centre for River Basin Environment, University of Yamanshi

In the Kathmandu Valley, capital city of Nepal, building infrastructure for water supply and sewage systems is delayed while water demand is higher population is rapidly growing in urban area. Because of the insufficient water-related infrastructure, people highly depend on ground water for domestic and agricultural uses, more than half of water demand, despite the chronic nitrogen pollution in ground water. In this study, ground waters were sampled from shallow dug and tube wells (3-30m) and deep tube wells (80-335m) in the valley, and pollution pattern and sources were analysed by using water quality tracers. While Na^+ or Cl^- concentrations in shallow wells were plotted along the linear line, Cl^- was not detected in most of deep wells. Assuming Cl^- is not supplied from geological sources in this region, shallow groundwater is possible to be influenced by infiltration from ground surface containing domestic waste water. Ammonium nitrogen was more frequently detected in deep wells than in shallow wells with 65% of exceeding rate for National Drinking Water Standard in Nepal (1.17mgN/L). The values of $\delta^{15}N\text{-}NH_4$ in deep well waters were in the range of 0 −0.1‰, supposedly derived from the lacustrine sediment of Paleozoic Lake Kathmandu. On the other hand, the values for shallow dug wells and shallow tube wells were higher than those for deep wells and were in the range of 3.0 −7.0‰ and 2.0 −5.0‰, respectively, implying the mixing of anthropogenic domestic or livestock waste waters and the natural lacustrine sediment. Nitrate nitrogen was not detected in most of deep wells and, in shallow wells, the exceeding rate for NDWS (11.3mgN/L) was lower than 20%. The $\delta^{15}N\text{-}NO_3$ in shallow dug well waters and shallow tube well waters were obviously higher than those of and were in the range of 9.0 −22.0‰ and 15.0 −23.0‰, respectively, The higher values of NO_3-N than NH_4-N can be partially caused by fractionation through denitrification and more possibly caused by mixing of anthropogenic sources. The results from this study indicate that, for resolving the nitrogen pollution of ground water, identification of the sources and fate is highly necessary in this region.

Keywords: Groundwater, Densly populated city, Nitrogen Pollution, Water quality tracers

