

AHW023-05

Room:102

Time:May 25 10:00-10:15

Denitrification and nitrous oxide production and consumption processes in a groundwater at Kathmandu Valley

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We investigated denitrification and its influence on nitrous oxide production and consumption processes by measuring nitrogen and oxygen isotopes ratio of dissolved nitrous oxide and nitrate, dissolved nitrous oxide concentration and other chemicals in the groundwater at Kathmandu Valley, Nepal. Nitrous oxide productions in a groundwater contaminated by nitrogen compounds were often investigated in the agricultural land. However, there are a few studies about that in urban groundwater. Nitrous oxide productions in the urban groundwater may be important as a nitrous oxide emission pathway in the case that groundwater is used as daily life water and heavily extracted.

Groundwater samples were collected from 36 shallow tube wells and dug wells (2.8-21 m) in Aug. 2009 and Aug. 2010. We collected the samples in a glass vials at plastic bucket filled with the groundwater to prevent gas exchange between groundwater and air. mercury chloride was injected to sample to decrease microbe activity in the sample. Nitrogen and oxygen isotopes of nitrous oxide and nitrate data and dissolved molecular nitrogen data showed nitrous oxide in the groundwater at Kathmandu valley was produced by denitrification or denitrification and nitrification. Moreover, dissolved molecular nitrogen data showed nitrous oxide was strongly reduced to molecular nitrogen by denitrification. Nitrous oxide production, consumption and consequent nitrous oxide concentration was considered to be mainly regulated by nitrate pool size. As the one of this reason, denitrification can easily occur in the groundwater at Kathmandu valley because of high dissolved organic carbon and low dissolved oxygen concentrations.

Keywords: denitrification, nitrous oxide, groundwater, Nepal, isotope