

Nitrification and denitrification processes in sediment and its influence on nitrogen dynamics in Lake Biwa

*Naoya Tsuchihashi¹, Ken'ichi Osaka², Yuhei Suzuki², Saki Yamada², Masahiro Maruo², Takashi Nakamura³, Kei Nishida³

1. Graduate School of Environmental Science, University of Shiga Prefecture, 2. School of Environmental Science, University of Shiga Prefecture, 3. Faculty of Environmental Science, University of Yamanashi

It has been well known that excess nitrogen loading on aquatic ecosystems causes severe environmental problems such as harmful algae outbreak and deterioration of water quality. Denitrification is a microbial process that reduce nitrate to di-nitrogen. Nitrification is important microbial process for denitrification because that produces nitrate from ammonium. These mean that co-occurrence of nitrification and denitrification reduces nitrate and ammonium concentration in aquatic ecosystem. In this study, we conducted sediment incubation experiments of sediment to determine nitrification rate and denitrification rate at sediment in Lake Biwa. We also collected lake water at 14 depths from May 2015 to Dec. 2016 in a month interval at first sedimentary basin of Lake Biwa, and analyze total nitrogen, dissolved nitrogen, ammonium, nitrate and nitrogen and oxygen isotopes of nitrate.

Nitrate concentration was higher in the deeper layer (50-80 m) than the surface layer (0-10 m) at all observation period, and the difference increased in latter stratification period. Moreover, nitrogen isotopes ratio of nitrate increased and oxygen isotope ratio of nitrate decrease in deeper layer at latter stratification period. These results mean new nitrate was generated at deeper layer at stratification period. The results of sediment incubation experiments and nitrate mass balance in water column show that increase of nitrate in deeper layer at stratification period was result of nitrification in water column. Moreover it is considered that the influence of sedimentary denitrification on nitrate consumption in water column was minor.

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