

Nitrogen and oxygen isotope fractionation during anammox in the activated sludge

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Anammox is an important nitrogen removal pathway in many ecosystems. However, it is still unclear how important the anammox is quantitatively compared with the denitrification. Natural abundance of ^{15}N and ^{18}O of nitrogenous compounds such as ammonium, nitrate and nitrite can provide unique information to investigate the relative contribution of anammox to the total nitrogen removal, although the lack of reports on isotopic fractionation factors in the anammox cannot allow us to explore the use of stable isotope signature in the anammox studies.

We incubated the sludge anaerobically to trace the changes in concentrations and isotopic signatures of ammonium, nitrite and nitrate during the anammox process to calculate the isotopic fractionation factors. We found the large isotopic fractionations for ammonium oxidation and nitrite reduction by anammox. In addition, the inverse isotopic fractionation during nitrite oxidation to nitrate was observed. Moreover, the exchange rate of O atom between water and nitrite was higher than previously thought, indicating the importance of this process in regulating the isotope systematics. In the presentation, we apply the isotopic fractionation factors obtained from our incubation experiments to make a simple process model to see if isotopic signatures can detect the anammox in the denitrification-dominated environment.

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