Investigation on the nitrogen (N) and oxygen (O) stable isotope dynamics in nitrate reduction coupled with Fe(II) oxidation
亚铁氧化耦合硝酸盐还原过程的氮氧同位素特征研究

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硝酸盐依赖的亚铁氧化作为微生物介导的中性亚铁氧化类型之一，是联系铁-氮耦合循环的重要过程。通常认为在厌氧环境下，硝酸盐和亚硝酸盐的还原过程主要是微生物作用的结果。然而，近年来研究发现吸附态和矿物结合态的亚铁也具有还原硝酸盐和亚硝酸盐的能力。氮、氧同位素能用于表征和区别其中同时发生的非生物与生物作用。拟申请项目将通过模拟中性厌氧条件的批处理实验，研究亚铁氧化耦合硝酸盐还原过程中反应物以及产物的反应动力学以及氮、氧同位素分馏特征，用以识别生物和非生物作用过程；同时通过稻田土壤体系模拟实验，结合反应动力学和同位素分馏特征、矿物表征和微生物群落分析等手段，揭示稻田土壤硝酸盐依赖亚铁氧化的生物与非生物作用过程，以期为土壤铁-氮耦合作用机制研究提供理论基础。

The Fe(II) oxidation and nitrate reduction mediated by nitrate-dependent Fe(II) oxidation microorganism is one of the most important processes in biogeochemical cycles of iron (Fe) and nitrogen (N) in the environment. Under anaerobic conditions, the environmental reduction of nitrate and nitrite is widely regarded as the result of microbial process. However, recent studies indicated that the chemical reduction of nitrate and nitrite by Ferris, whether mineral-bound or surface-associated, may also occur under relevant conditions. Nitrogen and oxygen stable isotopes potentially offer a unique approach to distinguish and study these two reactions and to improve our understanding of microbial and chemical process. The objectives of this project are as follows. (1) With a range of experimental conditions, we examine the kinetics of nitrate/ nitrite reduction and nitrous oxide production, and also the stable N and O isotope systematics during nitrate reduction in order to investigate the biotic and abiotic processes in nitrite reduction coupled with anaerobic Fe(II) oxidation system. (2) A combined methods such as chemical reaction kinetics, isotopic fractionation of N and O, mineral analysis, clone libraries and terminal restriction fragment length polymorphism (T-RFLP) analysis will be also conducted to explore the biotic and abiotic processes of nitrite reduction coupled with anaerobic Fe(II) in soil under relevant conditions. This work contributes to improve our ability to identify and evaluate the biotic and abiotic processes in coupling mechanism of Fe-N cycling in the environment.