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厌氧条件下水稻土中铁硫循环与光照的关系

Relationships of illumination with iron and sulfur cyclings in paddy soil under anaerobic incubation

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中文摘要:

采用恒温厌氧培养试验研究了黑暗、光照、黑暗转光照和光照转黑暗条件下水稻土中硫酸盐还原和铁的氧化还原。结果表明光照是调控土壤铁、硫生物化学转化的一个关键环境因素，光照对铁、硫还原的抑制作用体现在5 d后。黑暗培养30 d土壤游离铁的70.07%可被还原；光照培养时35.60 μmol g^{-1} Fe(III)先被还原后被氧化，30 d后仍有32.70%的游离铁被还原，转黑暗后被氧化的铁可再次被还原。黑暗时土壤中99.50%的水溶性硫酸盐（WSS）在可5 d内被还原，光照培养30 d有42.73%的WSS被还原。水溶性无机碳（WSIC）与体系中Fe(II)和WSS之间存在显著相关关系。无光照转换时水溶性有机碳（WSOC）与Fe(II)和WSS的转化速率存在显著正相关关系；黑暗条件下WSOC>7.89 μmol g^{-1}时，体系中Fe(III)和WSS还原；光照条件下WSOC>8.27 μmol g^{-1}时体系中Fe(III)还原，WSOC>8.40μmol g^{-1}时WSS还原。

Abstract:

Samples of paddy soil were prepared into slurry and then incubated anaerobically at a constant temperature for exploration of ef of illumination on reduction of sulfate and redox of iron in the soil. Water soluble inorganic carbon and organic carbon in the soil were analyzed simultaneously for relationship of anaerobic redox process of iron with sulfur and carbon transformation under illumination i the paddy soil. Results showed that illumination is a key environmental factor regulating geomicrobiological cycling of iron and sulfur. Inhibitive effect of illumination on reduction of iron and sulfur was observed after 5 days of anaerobic incubation. After 30 days of anaerobic incubation in the dark, 70.07% of free iron was reduced in the soil; and in the soil incubated under illumination, 35.60 μmo Fe(III) was reduced first and then re-oxidized, and after 30-days, the soil still had 32.70% of its free iron reduced. After the illuminat was turned off those oxidized Fe could once again be reduced and 99.50% of the water soluble sulfate in the soil was reduced within days. In soils anaerobically incubated for 30 days under illumination, 42.73% of the WSS was reduced. The date when the maximum reaction rate of iron reduction or oxidation appeared came prior to the date when maximum reaction rate of sulfur transformation wa observed. Close relationship of water soluble inorganic carbon with Fe(II) and water soluble sulfate in the soil were found, and signific positive relationships were also found of water soluble organic carbon (WSOC) with iron or sulfur transformation rate in the soil unde incubation without shifting between illumination and darkness. In the soil under dark incubation when WSOC in the soil was > 7.89 μ g^{-1}, Fe(III) and water soluble sulfate (WSS) tended to be reduced, while in the soil under illuminated incubation, when WSOC was >

μmol g^{-1}, Fe(III) did and when WSOC was > 8.40 μmol g^{-1}, WSS did.