

研究论文

外源氮对沼泽湿地CH₄和N₂O通量的影响

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摘要 三江平原沼泽湿地受到大气沉降、地表径流、农业排水等外源氮素的输入,对湿地生态系统CH₄和N₂O通量有重要影响。采用野外原位施肥试验模拟外源氮输入,设0, 60, 120, 240kgN•hm⁻² 4种试验处理,探讨外源氮对沼泽湿地CH₄和N₂O通量的影响。结果表明,外源氮促进了CH₄和N₂O排放。与对照处理比较,各施氮水平CH₄平均排放通量分别增加了181%, 254%和155%, N₂O排放通量分别增加了21%, 100%和533%。外源氮输入对CH₄排放的季节变化形式影响不大,而N₂O的季节变化形式随着氮输入表现出波动变化的趋势。不同施氮水平对CH₄排放的促进作用与植物生长阶段和产CH₄的微生物过程密切相关, N₂O排放通量随氮输入量呈指数增加 ($R^2=0.97$, $p<0.01$)。外源氮通过影响湿地微生物过程来进一步影响CH₄和N₂O的排放。

关键词 外源氮; 沼泽湿地; CH₄和N₂O通量

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Effects of exogenous nitrogen input on the CH₄ and N₂O fluxes in freshwater marshes

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Abstract CH₄ and N₂O are the two main greenhouse gases with great contribution to global warming. Natural wetland in the north hemisphere is recognized as one of the most important global sources of atmospheric CH₄. But its role in contribution to N₂O is not clear. Nutrient enrichment may impact the greenhouse gas emission from freshwater marshes. As the largest freshwater marsh distribution area in China, Saijiang Plain has experienced the extensive reclamation over the past 50 years. Large area of the marshes was drained for agricultural production. The remained marshes are often subject to high levels of nitrogen enrichment from atmospheric deposition, surface runoff loading and agricultural drainage, which affected the CH₄ and N₂O emission from marsh ecosystem. In this work, we discuss the effects of exogenous Nitrogen on the CH₄ and N₂O fluxes of marshes using an in situ field fertilization experiment with the static chamber technique. Ammonia Nitrate solution were applied at a rate of 0 (control), 60, 120kgN•hm⁻² and 240kgN•hm⁻². Monitoring results showed the maximum CH₄ flux of these four levels is 3.67mg CH₄ m⁻² h⁻¹, 11.01 mg CH₄ m⁻² h⁻¹, 11.28 mg CH₄ m⁻² h⁻¹ and 5.82 mg CH₄ m⁻² h⁻¹, While the maximum N₂O flux is 0.27 mg •m⁻²•h⁻¹, 0.65 mg•m⁻²•h⁻¹, 1.0 mg•m⁻²•h⁻¹, 2.26 mg•m⁻²•h⁻¹. The results indicated exogenous nitrogen input increases the CH₄ and N₂O emission. Comparing with the control level, the CH₄ flux of other three fertilization levels increases by 181%, 254%and 155%, and th

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e N₂O fluxes increased 21%, 100% and 533%, respectively. During the growing season, nitrogen input does not have obvious influence upon the seasonal dynamic pattern of CH₄ emission flux. But every Nitrogen input, especially of the highest level, brings about the obvious fluctuation of the N₂O emission flux. With the increasing of nitrogen input, there is an exponential increase trend of N₂O flux ($R^2=0.97$, $p<0.01$). CH₄ flux under the high nitrogen input was lower than those under the low and medial nitrogen input, which was related to the plant growing stages and the microbial activity of CH₄-producing. The exogenous nitrogen input changed the CH₄ and N₂O fluxes not only via the direct effect but also by affecting the wetland microbial process.

Key words exogenous nitrogen – freshwater marshes – CH₄ and N₂O fluxes

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